28th Congress, 1st Session. Rep No. 479. Ho. of Reps.

ACCIDENT ON STEAM-SHIP "PRINCETON."

MAY 15, 1844.

Read, and laid upon the table, and 2,000 copies extra ordered ~~to be~~ printed.

Mr. PARMENTER, from the Committee on Naval Affairs, made the following

REPORT:

The Committee on Naval Affairs, to whom were referred certain communications from the War and Navy Departments on the subject of large wrought-iron guns, and in pursuance of the duty assigned them by the House of Representatives, submit the following report:

On the 28th day of February last, a large wrought-iron gun exploded on board the United States steam ship of war Princeton, under command of Captain Robert F. Stockton, by which accident the Hon. Abel P. Upshur, Secretary of State, Hon. Thomas W. Gilmer, Secretary of the Navy, Captain Beverly Kennon, chief of the Bureau of Construction, Equipment, and Repairs, Virgil Maxcy, esq., of Maryland, and Colonel David Gardner, of New York, were killed, and from sixteen to twenty other persons were wounded; one of them (a servant of the President of the United States) mortally.

This disastrous calamity occurred near the city of Alexandria, while the Princeton was on an excursion with many visiters on board. An event so appalling, connected with the public service, required an investigation with a view to ascertain to what extent it was one of those accidents which occasionally occur beyond the reach of prudent and skillful management; and, also, what measures, if any, should be taken by Congress to prevent the recurrence of similar disasters.

The first point which presented itself to the committee was, whether any fault existed with those on duty at the time. On application to the Secretary of the Navy, they have been furnished with a copy of the proceedings of the naval court of inquiry, which, with its accompanying papers, is appended to this report. In the opinion of the court, no blame is attributable to the officers and men on duty at the time. This opinion the committee think is fully sustained by the evidence in the case.

It then became desirable to ascertain if there were any defects in the material, formation, or fabrication of the gun. For that purpose, at the request of the committee, on the 23d day of March, the House of Representatives adopted the following resolution; the last clause, in relation to the expenses, having been added as an amendment by the House:

"*Resolved*, That the Secretaries of War and of the Navy each inform this House what experiments have been made by officers of their respective departments for the purpose of testing the strength and utility of cannon manufactured from wrought iron, specifying such particulars as may tend

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to show the relative strength and utility of wrought-iron and cast-iron cannon; and that they severally furnish copies of all reports made by ordnance or other officers, either of the War or Navy Departments, which may be in their possession, on the subject of this inquiry, and give such other information connected therewith as they may consider useful; also, that they respectively inform the House, as far as may be in their power, what has been the result of the experience of European powers on the subject, and particularly the largest size to which wrought-iron cannon for solid shot have been carried with success.

"And that the Secretaries also report the expenses of said experiments, and to whom the money was paid."

In answer to this resolution, the Secretary of War, on the 6th of April, communicated to the House such information as his department possessed, relative to its own experiments, and an historical statement of the experience of European powers in wrought iron guns; which reply, with the papers referred to, is submitted with this report.

The Secretary of the Navy transmitted, on the 17th day of April, several documents in reply to the resolution of 23d of March, including a statement of the proceedings of Captain Stockton in relation to the two large guns on board the Princeton, one of which was that which exploded. These papers are also appended.

In answer to inquiries as to the authority by which the guns were procured, and what proceedings have been had in regard to them, the committee have been furnished with copies of the correspondence on these points. The letters are numerous; but, as they principally relate to claims for payment, and mode of proving the guns, it is not thought necessary to report them.

It appears that these large guns were purchased by Captain Robert F. Stockton, without any express order from the Navy Department; and, as far as can be learned by the committee, the building of the Princeton, and the procurement of her armament, were under his direction. One gun was procured from iron works in England, the other from an American establishment. From all the papers reported to the House, and furnished on the calls of the committee, they do not find that any of the proper officers of the Government had anything to do with the guns, except to direct them to be proved, and to agree to the payment of the bills of cost after they were procured. Neither do the committee learn that the construction of the Princeton was supervised by the officers of Government charged with that branch of the public service. Everything seems to have been left to Captain Stockton, to enable him to carry out his own peculiar views.

These guns were not ordered, originally, by the advice of the Ordnance department of the navy, as would seem to be the proper course—that being the branch of the service instituted by law for the regulation of the naval armament. Bureaus are established, and scientific officers placed in charge of them, for the purpose of enabling the executive department to be possessed of the means of deciding with the advantage arising from the skill and attainments of competent officers in the different branches of the public service. It was irregular to permit an officer unconnected with the Construction or Ordnance department to proceed with so little restraint in the ilding and arming of a ship of war, as was the case with regard to the ceton.

ew of the full representations which have been made in relation to

wrought-iron guns, the committee have not thought it necessary to ask for authority to visit a distant harbor, or to institute a commission for the purpose of examining the fragments of the exploded gun, or to obtain any further evidence of the fidelity of its fabrication. The objections in the information furnished are made against the material and size of guns of the description treated of.

By other documents communicated with this report, it will be seen that, on the 14th day of March last, the President of the United States ordered another gun of the size and dimensions of that lately destroyed to be made "under the direct supervision of Captain Stockton." This gun the committee are informed is in a state of forwardness, and, it is supposed, will be finished in August next.

The committee have no disposition to advise an interference with the duties of the Executive, by undertaking to prescribe the exact mode of arming our public ships. But they feel bound to express the opinion, that an unusual species of armament, attended with danger, should not be introduced into the public service until it receives the full approbation of the ordnance officers as to its efficiency and safety. It may also be a question, in consideration of their great cost, and the fact that, so far as our navy is concerned, they are an experiment, whether these large guns should not be specifically directed by Congress before they are procured.

The committee do not, however, propose any legislation at the present session. They trust that the sad event which has given rise to this investigation, and the information elicited by this inquiry from intelligent ordnance officers, will lead to cautious proceedings in a matter of such importance to the success and reputation of the navy, and one in which the lives of those engaged in the public service are so deeply concerned. The committee ask to be discharged from the further consideration of the subject.

NAVY DEPARTMENT, *March* 18, 1844.

SIR: I have the honor to transmit herewith a copy, as requested in your letter of the 13th instant, of the report of the court of inquiry ordered to investigate the causes of the recent disaster on board the United States steamship Princeton.

Very respectfully, your obedient servant,

L. WARRINGTON,
Secretary of the Navy ad interim.

Hon. WM. PARMENTER,
Chairman of the Committee on Naval Affairs,
House of Representatives.

By virtue of a precept from the Hon. Lewis Warrington, Secretary of the Navy *ad interim*, bearing date the fifth day of March, in the year eighteen hundred and forty four, and hereunto annexed, (marked A,) a naval court of inquiry assembled on board the steamship Princeton, lying at anchor in the river Potomac, opposite the city of Alexandria, on Thursday, the seventh day of March, eighteen hundred and forty-four, at the hour of 4 o'clock, p. m.

The said court was constituted as follows:

President.—Captain William C. Bolton.
Members.—Captain Isaac McKeever, Captain John H. Aulick.
Judge Advocate.—Richard S. Coxe.

The precept having been read, and all the members of the court being present, the oath prescribed by law was duly administered to the president and members by the judge advocate; and, in like manner, the oath, as prescribed by law, was duly administered by the president to the judge advocate.

The court adjourned to meet to-morrow morning at 11 o'clock, at Fuller's hotel, in the city of Washington.

FRIDAY, *March* 8.

The court met pursuant to the adjournment of yesterday. Present: all the members of the court and the judge advocate. The proceedings of yesterday were read.

The judge advocate having requested an opportunity of conferring with the Secretary of the Navy on the subject of the court, proceedings were suspended for two hours; and, on the return of the judge advocate, the court adjourned until to-morrow at 10 o'clock, a. m., at the same place.

SATURDAY MORNING, *March* 9, 1844.

The court met pursuant to the adjournment of yesterday. Present, as before.

The judge advocate presented to the court a note addressed by him to Captain Stockton: read and ordered to be annexed to the record, marked B; also Captain Stockton's reply, which, with the enclosed letter from Colonel George Bomford, of the Ordnance Department, was also read and ordered to be annexed to the record, (C and D.)

Francis B. Ogden, a witness produced by the judge advocate, being duly sworn, deposes and says:

I recollect, some time in the year 1839, to have had a conversation with Captain Stockton, then in London, on the practicability of manufacturing large guns of wrought iron; that William Young, then manager of the West Point foundry, and Captain Ericsson, were also present; and all agreed that, if so large a mass of iron as would be required, could be perfectly welded, a gun so constructed, from the superior strength of the material, would possess advantages that could be obtained in no other manner. The observations I had made on the progress of the manufacture of large shafts for steamers, and of the great perfection to which it had been carried, (such masses of wrought iron having never before been welded together,) induced me to believe that the junction could be made perfect; and I had no reason to suspect that the iron would not retain all its original tenacity. Such also was the opinion of Mr. Young and Captain Ericsson. After much deliberation and several consultations, with *accurate calculations* before him of the relative strength of different materials, Captain Stockton eventually commissioned me to have a wrought-iron gun forged and bored out to carry a shot twelve inches in diameter—such dimensions having been agreed on, as we were all satisfied would afford sufficient strength, namely: twenty-

four inches abaft the trunnions, and tapering thence to eighteen at the muzzle. I contracted with the proprietors of the Mersey works for such a shaft, to be forged of the best Yorkshire iron—they warranting it to be perfectly welded, and without flaw or crack inside or out. On a strict examination I was satisfied with the work, and shipped it, unfinished except in the bore, to New York, whence I understood it was sent to Philadelphia to have the trunnions shrunk on, and to be otherwise fitted for service. I afterwards learned that, being proved, it showed some symptoms of weakness, which induced Captain Stockton to have other bands, $3\frac{1}{2}$ inches in thickness, shrunk on the after part from the trunnion to the breech. In this state, the experiments that have been made public, were made with it at Sandy Hook; and I was informed that a final trial was made by firing it with a charge of 25 lbs. of powder, and shot weighing 212 lbs., forty-four times in one day—the longitudinal crack abaft the trunnions being so open as to admit the escape of smoke from the burnt powder at each discharge, and even suffering water to leak through it. With these facts before me, that the gun had opened longitudinally, and, of course, had lost all tenacity in that part of its original structure, and afterwards depended alone on bands $3\frac{1}{2}$ inches thick, I was confirmed in my opinion that wrought iron might be split, but could never be rent asunder; and $3\frac{1}{2}$ inches of metal having stood such severe trials, that the new gun, with these bands *welded* upon two inches greater diameter than the first one measured, would be perfectly safe under any trial. I saw the process of boring the new gun in New York, and frequently, in company with Captain Ericsson, examined the shavings that were cut out of it; they appeared to be tough, and iron of the best quality; and so satisfied were we with the work, in every particular, that neither of us entertained the least doubt of its standing any proof it could be subjected to. I was further confirmed in my confidence by the severe proof it underwent in New York with $49\frac{6}{10}$ lbs. of powder, and in witnessing its discharge twice on the day the Princeton was first visited by the President. I stood immediately behind it, without the least apprehension of danger.

It has been said that such guns have been tried before, and, the experiment having failed, the project was abandoned. This cannot possibly be true; for it is well known that, until very recently, the welding together of such a mass of iron was never attempted. In former times, the forging of an anchor for a line-of-battle ship was considered the heaviest job that could be executed; and the demand alone for shafts for large steamers has brought this heavier work into existence—to execute which, entirely new arrangements are to be made with the fires, hammer, &c. I think I do not risk anything in the assertion, that the metal of the "Peacemaker" is the largest mass that ever was brought under a forge hammer. The shank of an anchor will occasionally break short off; but who has ever reasoned from this fact, that cast iron would be a better material for an anchor than wrought? Who would fire a cast-iron musket, or fowling piece, or pistol? Who would shoe his horse with cast iron, or indeed ever use it, where tenacity was required, in preference to wrought? No facts, within my knowledge, have ever been recorded to show that the quality—the nature, I may say—of wrought iron undergoes such a change, when welded together in masses, as it would appear the metal of the *bursted* gun has undergone. The fibrous quality of the iron appears to be wholly destroyed; large crystals form the mass; and the specific gravity is found to be 9 per cent.

less than that of ordinary hammered iron. No doubts were entertained as to the quality of the bars of iron from which the gun was forged; it was supposed to be the very best that could be procured; if so, some chemical or organic change must have taken place in the manufacture, hitherto unknown and undreamed of.

Those, therefore, who would rely on former experience could have no surer guides than appear to have led to the introduction and use of this gun.

Question by the Judge Advocate. Will you please to state particularly the knowledge you may possess of the character of Mr. William Young as a man of science, and particularly as to his practical acquaintance with the manufacture of iron?

Answer. I have known Mr. Young many years—first as the manager of the West Point foundry, and afterwards of the Ulster iron works, and now manager of the Mount Savage iron-works, near Frostburg, Allegany county, Maryland. His general reputation is, and I have always so considered him, as a man of science in his profession, and as possessing the best practical knowledge of the manufacture of iron. He has executed large contracts with both the War and Navy Departments, and to the entire satisfaction of those departments.

Question by the same. You have spoken of accurate calculations which led Captain Stockton to form his judgment and decision as to the construction of large guns of wrought iron: what were they?

Answer. They were, as I understood at the time, calculations, I believed, made by Captain Ericsson from scientific works on the subject, and from his own experience.

Question by the court. You have mentioned the Yorkshire iron; what is the character of that iron?

Answer. It is considered the best used in England for tenacity and strength, and is much used for steam-engines particularly. I speak of the iron made at Low Moor works, from which the iron of which the first gun was made came. But I do not consider that iron as equal to the best American iron.

Question. Do you know anything of the character of the works where the "Peacemaker" was fabricated?

Answer. I do not.

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William E. Hunt, a lieutenant in the navy of the United States, being duly sworn, deposes and says:

Question. Will you please to state such information as you possess as to the experiments and proof of the large guns on board the Princeton, and the circumstances attending the loading and explosion of the same, and your rank and station on board said vessel?

Answer. Having been, by orders from the Navy Department, detailed for special duty under Captain Stockton, in compliance with orders from him, I proceeded to New York; found there a large wrought-iron gun, said to have been manufactured in England; had it conveyed to Sandy Hook for the purpose of proving, and making other experiments with it. The gun was landed at the Hook; and upon the arrival of Captain Stockton, all the necessary arrangements having been completed, he proceeded to prove the gun with the following charge: 35 lbs. powder, 40 yards above navy proof, a wad filling the chamber; one shot of 212 lbs. in weight, and a wad over it. I then proceeded, by order of Captain Stockton, to mount the gun on a

carriage prepared for other experiments. On rolling the gun over, a small crack opposite was discovered. This was examined, and, although it was at the time not supposed to extend through the chamber, it was thought advisable to strengthen the breech by putting bands around it. An order was given to that effect, and further experiments postponed. After being banded, the gun was again mounted and the experiments continued. After firing about twenty times with cartridges varying from 14 to 25 lbs., the shot of 212 lbs., it was found that the crack in the lower part of the breech had opened through into the chamber, to such an extent that in washing the gun, water drained through the rent. It was then determined to ascertain how many discharges of 25 lbs. of powder, with a shot of 212 lbs., the iron hoops, which were about $3\frac{1}{2}$ inches in thickness, would bear without bursting. On the following day the gun was fired 44 times with 25 lbs. powder, 28 yards above navy proof, and each shot weighing 212 lbs., without any visible effect, except that the exploded powder blackened the outside of the hoops directly over the rent in the gun. Having fired from this gun from 120 to 150 shot without injury to the hoops, which alone sustained it, and having by such means ascertained to our entire satisfaction that a wrought-iron gun, if over strained, would only *open*, not fly to pieces, and that about $3\frac{1}{2}$ inches of good wrought iron would sustain such firing as this gun had been exposed to, we believed that a gun could be made of American iron sufficiently strong to stand any number of pounds of powder that could be burnt in it. In consequence of these results, Captain Stockton ordered another gun made with a similar chamber to that of the first gun, with an additional thickness of 12 inches metal at the breech. After this gun was made, it was proved with $49\frac{6}{10}$ lbs. of powder, navy proof, and a shot of 212 lbs. This gun was afterwards examined, and found, to all appearance, to be perfect; and was pronounced by Captain Stockton, Captain Ericsson, myself, and one of the manufacturers, capable of sustaining any charge that could be put in her. The gun was then taken on board the Princeton, soon after which the Princeton came to this place. A few days before the President's first visit to the ship, the ship was got under way, and proceeded down the river, for the purpose of firing the forward gun, and seeing all was right. One charge of 25 lbs. of powder, and one 30 lbs., with 212 lbs. shot each, were fired, and the gun thoroughly examined after each discharge, and found to be, as far as could be seen, quite perfect. Believing that the gun could be tested in no other way more satisfactorily, and its strength being entirely relied upon, the ship returned to her anchorage. A few days afterwards the ship made another excursion down the river, with the President and other company on board; on which occasion the forward [gun] was loaded and fired three times—once with 30 lbs. powder, and 100 lbs. hollow shot, and twice with 25 lbs., and 100 lbs. hollow shot. The gun, as has been usual since the commencement of the experiments, examined after every fire, and seemed to be entirely sound. A few days afterwards another excursion was made down the river with the members of Congress, and the same gun fired three times, with 25-lb. cartridges each time, and 100-lb. hollow shot—the gun examined after each discharge, and found still whole and entire as before. The ship returned to her anchorage. Several days afterwards, (on Wednesday, the 28th February, 1844,) the ship made another excursion down the river—the President of the United States, and a large party of ladies and gentlemen, invited guests, on board. Upon this occasion, my orders from Captain Stockton were to have all in readiness to fire

the bow gun after passing Alexandria a short distance. The gun was loaded and got ready to fire. I reported the gun ready, when Captain Stockton came forward, taking his usual position nearest the gun, ordering others away, to prevent any accident from recoil of carriage, and fired the gun. The gun was examined, and found to be all right as before. The gun was fired a second time under similar circumstances, and, as I supposed, for the last time that day. After the ship had been put about on her return up the river, a request was made by some of the gentlemen on board that the gun might be fired again; which request I had conveyed to Captain Stockton, and received from him orders to load the gun as had been done in the two previous discharges, viz: with 25 lbs. of powder, and one shot of about 212 lbs. The gun was reported ready to fire. Captain Stockton came forward, taking his usual position nearest the gun, and in the most exposed place, and, with one foot on the bed, gave his usual order: "Stand clear of the gun," and fired her; at which fire the gun burst. The gun was loaded in this instance in the same manner as before, viz: a cartridge containing 25 lbs. of powder was placed in the muzzle of the gun; a rammer, with a head nine inches in diameter, made for the purpose, and marked to show when the cartridge was home, was used to slide the cartridge into the after part of the chamber of the gun; Mr. King, the gunner, attending with priming wire to report it home, which he did in each instance. A wad ten inches in diameter by nine inches long was then placed on the cartridge, and rammed home, completely filling the chamber; one round shot weighing about 212 pounds was rolled home against the cartridge wad with a rammer, the head 12 inches in diameter. A wad 12 inches in diameter by 6 inches long was introduced and rammed home, the rammer marked to show when the charge was home. This was the manner of loading in each instance, with the exception of the last—I myself having introduced the cartridge into the muzzle of the gun; the same men employed each time in loading.

Everything that was calculated to insure, so far as human skill, prudence, and foresight, could secure safety from the firing of these guns, was done by Captain Stockton, from the commencement of his experiments up to this time.

Question by Judge Advocate. You speak of the gun being, in your opinion, capable of bearing any quantity of powder which could be burned in her. Do you mean that, if there is an over-charge of powder, any part of it will leave the gun without exploding?

Ans. I mean that, in such case, powder will be blown from the gun without being burned.

Question by the court. At what manufactory was the powder made with which the gun was fired on the several occasions you have mentioned?

Ans. I believe it was made at Dupont's manufactory, Delaware.

Ques. Are the wads shown to you the same, in class and character, as you have spoken of?

Ans. Yes.

Ques. What is the composition of them, and how are they measured?

Ans. They are made of rope-yarn and junk in the ordinary way, passed through a former to be adapted to the size of the chamber or calibre of the gun; they are not loaded wads.

Ques. What is the windage of the rammers?

Ans. The smaller rammer an inch, the larger a half inch. The rammer before the court is one of them.

Ques. Will you please describe the size of the cartridge and wad employed, and whether they are calculated to fill the entire chamber of the gun?

Ans. The size of the cartridge of 25 lbs. powder by measurement, when settled down in the gun, is twelve inches long, and of the diameter of the chamber. The wad formed to cover the cartridge in the chamber, is nine inches long by ten in diameter, corresponding with the diameter of the chamber. The cartridge and wad are put in separately; when rammed home extending to the bevel of the chamber, about twenty-one inches in length. The shot can then extend about four inches into the chamber, with a 25 or 30 lb. cartridge. The shot would rest against the bevel of the chamber. The weight of the shot compressing the wad and cartridge about two inches beyond what it was before the shot was inserted. In loading the gun, it has been our invariable rule to depress the breech of the gun about eight degrees, and also to feel that the shot was fully home, or hear it strike the bevel of the gun, before putting in the last wad. A 25 and 30 lb. cartridge, with the small wad over it, completely filled the chamber of the gun, with the usual force of two men employed to ram it home. The ball upon it then compressed it about two inches. By measurement, on several occasions, the shot was ascertained, with such charge, lying against the bevel of the chamber. The powder is all in flannel cylinders, each in a separate copper cannister, each cannister marked No. 1, 2, or 3. No. 1 is the charge of 30 lbs.; No. 2, of 25 lbs.; No. 3, of 14 lbs. The cartridges in general of the two first classes; a few only of the smaller, or third class. The rammer is graduated and marked, so as to show when each portion of any and every charge has attained its proper position in the gun.

Ques. What was the usual position of the officers and crew of the Princeton immediately concerned in the firing the gun, and what was their position at the time of the explosion?

Ans. In general, the position of the officers and crew was at their quarters. On this occasion, Captain Stockton stood behind the gun, the nearest to it, with his left foot on the bed of the gun. Witness stood alongside of Captain Stockton, a little quartering the breech of the gun. Mr. King, the gunner, on my left, near the larboard trunnion of the gun. Captain Stockton, Mr. King, and myself, nearer by several feet to the gun, than any other person. Mr. Thomson, the officer of the deck, and the other officers generally, attending to the company.

Ques. What was the manner of firing the gun on that occasion?

Ans. The breech of the gun being at its greatest depression, the lock was cocked and set to rolling motion at an elevation of three degrees, the lock being self acting; a cord was then passed around the wheel attached to the crank of the elevating screw used for the purpose of imitating the rolling motion of the ship at sea, and manned. By hauling upon this cord, the muzzle of the gun was depressed to the point of elevation at which the lock was set, when instantly the cap burned, and the charge exploded.

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Robert S. King, gunner of the Princeton, being duly sworn, deposes and says:

Question. What information can you furnish the court upon the subject

of the experiments, proof, and explosion of the large gun on board the Princeton?

Answer. I assisted Lieutenant Hunt in the experiments at Sandy Hook. In regard to the gun which exploded, called the "Peacemaker," the first charge was 14 lbs. of powder, and no ball; the second, 20 lbs. powder and a wad; the third, 25 lbs. powder and a wad; fourth, 45 lbs. powder with two wads, and a ball of about 212 lbs. Estimating the powder at navy proof, it would be 49 lbs. The gun was afterwards examined by Captain Stockton, Captain Ericsson, Mr. Hogg, one of the manufacturers, Mr. Hunt, and myself, and no defect, inside or outside, could be discovered. The gun was then taken to the navy yard, and placed on board the Princeton. Since that time, she has been fired seventeen times up to the time of the explosion—five times with solid shot, five times with hollow, and seven times with wad only. Every day, after the firing, I washed her out with warm water, and after every fire I examined her myself on the outside. After the first fire of the gun at Sandy Hook, I saw a small scale on the inside of the gun, about a foot from the muzzle, where it is still visible. Mr. Hunt was always very particular in loading the gun, and on every occasion personally superintended it. The last loading of the gun, he himself put the powder in the gun. I was always at the priming wire. After the fifth or sixth firing of the gun, Captain Stockton assisted himself, and marked the rammer. The cartridge was always carried home with the rammer; a wad of 10 inches placed in the chamber, and that rammed home; the ball put in the muzzle, rolled home; and, by the priming-wire, it could be perceived that it compressed the powder. I do not think the gun has been fired at a less elevation than three degrees. The powder was all weighed and placed in the cartridges and cannisters. I also superintended some of the experiments with the first of the large guns, but they had nearly concluded before I reached Sandy Hook, August 11th, 1843. At the Hook I fired the first gun, (the Oregon.) Prior to my going there, she had been fired, and I discovered that water ran through her. I fired her twice with charges of 25 lbs. powder, and ball of 212 lbs.; once with 14 lbs. powder, and ball. On examination, it was found that no change had been produced by this firing. This was, I believe, the last of her firing.

The "Peacemaker" was made at the foundry of Mr. Ward, in New York.

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Hugh Kelly, quarter-gunner on board the Princeton, being duly sworn, says:

Ques. Were you at Sandy Hook when the experiments and trials of the "Oregon" and "Peacemaker" were made? If so, state what was your duty.

Ans. I was there as foremast hand; was connected with the loading of the gun, and to the washing and attending to the gun. In washing the "Oregon," the crack was discovered—the water running through. Bands were put round the gun, and the experiments continued, and I perceived no change in the gun, or in the crack in it, during the subsequent firing. I assisted in loading the gun, putting in the shot, on the day of the explosion; the loading was done in a perfect way; never saw more care taken. I had assisted in loading her about twelve times.

Edward Parker, fireman on board the Princeton, sworn and deposes:

Ques. Were you at Sandy Hook when the experiments and trials were made on the "Oregon" and "Peacemaker;" and have you since been on board the Princeton?

Ans. Yes.

Ques. What was your duty at Sandy Hook?

Ans. I was at the elevating screw at the first fire; the gun was on the sand, not on a carriage; the charge was 35 pounds powder, as I understood, and a solid shot. After the fire, examined the gun, and found a crack. We then mounted her on a carriage, and fired, I think, three rounds with 14 pounds powder, and solid shot; no change was perceived. The firing then stopped, and bands of I believe 3½ inches thickness were put on her. After the bands were put on, we continued our firing, and fired I should think, at different times, 150 shot—sometimes 15 or 20 a day, and in rapid succession. Saw no change in the gun or the crack, and felt under no apprehension. The charges ranged from 14 to 25 pounds.

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James Granger, a seaman on board the Princeton, being duly sworn, says:

Ques. Were you on board the Princeton, and did you assist in loading the gun which burst?

Ans. Yes.

Ques. State whether the loading was as usual, and was it carefully attended to, and by whom?

Ans. I assisted in loading the gun from the time she was taken on board. She was always carefully loaded, and on the last occasion as carefully as I had ever known her. Harrington assisted in the loading. Mr. Hunt superintended and directed everything, and every order that he gave was carefully performed.

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David Harrington, seaman on board the Princeton, being duly sworn, says:

Ques. Were you on board the Princeton on the day of the explosion of the large gun? Did you assist in the loading? State what you know.

Ans. Was on board; assisted in the loading; assisted in loading the gun on every occasion but two, from the time it was taken on board; great care and attention was always given to the loading; on the last occasion every care was taken, and I particularly, after the ramming down of the charge, rammed it again myself, to be perfectly sure that everything was right. Granger assisted in the loading. Mr. King, the gunner, was at the priming wire, and reported it was home. Mr. Hunt superintended, and ordered everything relating to the loading.

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Captain W. C. Bolton, president of the court, being duly sworn, says:

Ques. Were you on board the Princeton at the time of the explosion of the large gun? What did you observe as to the conduct of Captain Stockton, the officers and crew of the Princeton?

Ans. I was on board the Princeton on that occasion, as one of the invited guests. I considered the conduct of the captain, officers, and crew, under such appalling circumstances, highly praiseworthy and meritorious—especially that of Lieutenant Thomson, who came more immediately and constantly under my observation, he being officer of the deck for the day. I happened to be the senior naval officer on board and on deck when the explosion occurred. I saw Captain Stockton some twenty minutes after he was carried below, for the first time after the explosion; he was apparently much injured, and suffering great pain. Before the ship anchored I saw him a second time, and spoke cheeringly and soothingly to him. He appeared self possessed and much composed, and I considered him as perfectly competent to give any orders.

The testimony being now closed, the court proceeded to take the same into consideration, and to deliberate upon the opinion which, by the precept, they were required to report.

REPORT.

The naval court of inquiry, convened by order of the Secretary of the Navy, by a precept under his hand, bearing date the 6th day of March instant, for the purpose of inquiring into the conduct of Captain Robert F. Stockton and officers, in relation to the experiments and proofs which preceded the construction, and the proof and subsequent explosion of one of the great guns of the Princeton, occasioning the awful and distressing catastrophe which has recently occurred on board the said ship, and to report the opinion of said court on the matters thus referred to it—respectfully submit to the consideration of the honorable the Secretary of the Navy, the evidence which has been laid before it in relation to the premises.

In further performance of the duty imposed on it, the court further respectfully report, that, in pursuing the investigation with which it has been charged, the court was limited to the facts and circumstances immediately connected with the captain and officers of the Princeton, anterior to and immediately attending the explosion of one of the large guns on board that vessel on the 28th February last. This investigation has satisfied the court—

1. That in the year 1839, Captain Stockton being in England, his attention was attracted to the extraordinary and important improvements which had recently been introduced into the manufacture of large masses of wrought iron, as a substitute for cast iron, for objects which required a combination of strength and adhesiveness or toughness. Large shafts for steam-engines had been thus fabricated, which experience has demonstrated to be superior, in those qualities which were desirable, to the same articles manufactured of cast iron.

These circumstances appear to have led Captain Stockton to consider the question how far the same material might be employed in the construction of cannon of a large calibre. He appears to have been animated by motives the most patriotic—stimulated by the laudable desire of being himself instrumental in promoting the honor of his country, and of elevating that branch of the service with which he was personally connected. To what extent his inquiries were carried, the court has not been advised; but it is in evidence that he did advise and consult with three gentlemen possessing,

from their scientific acquirements and practical experience on such subjects, very superior qualifications in questions of this character, and whose opinions were entitled to high respect. Mr. William Young, Captain Ericsson, and Francis B. Ogden, esquire, are the gentlemen to whom allusion is made. After much deliberation and several consultations, with calculations furnished from the same quarter, Captain Stockton determined upon the construction of a gun of the proposed dimensions, for the purpose of testing the opinions of scientific men by the results of experience. A cannon was accordingly made at the Mersey works, of Yorkshire iron, which, being approved of, was shipped to the United States. Having been properly prepared for the purpose, this gun was carried to Sandy Hook, and subjected to what was deemed the proper test. After the first firing, preparations were made to mount the gun; in doing this, a crack was perceived opposite the chamber, which induced Captain Stockton to have the breech strengthened by putting bands around it. These bands are represented as being $3\frac{1}{2}$ inches in thickness. With this additional strength given to the defective part of the gun, the experiments were renewed, and the result was a decided conviction upon the minds of all connected with them, that, in general, the anticipations of Captain Stockton were perfectly realized; and, secondly, that if a gun of this construction should yield to the force of the trial, it would be by a simple opening, and not, as in cast iron, a violent disruption and scattering of the fragments. The success of these experiments was such as to decide Captain Stockton forthwith to direct the construction of another gun of a similar character, to be made of American iron, which is usually regarded as superior in strength and tenacity to the English iron. This second gun (the same which exploded on board the Princeton) was constructed with a chamber similar to that of the first gun, with an additional thickness of 12 inches at the breech—a difference (even if the metal were only of equal goodness) far more than sufficient to compensate for the bands by which the first had been fortified.

Application was made to Colonel Bomford, of the Ordnance department of the army, who, it is well known, has been professionally occupied in experimenting upon guns of a large calibre, and his opinion requested as to the proper proof to which such a gun ought to be subjected. The proof suggested by Colonel Bomford as a suitable one will be found in his letter of November 25, 1840, appended to the record. The new gun constructed by order of Captain Stockton exceeded in dimension and weight, consequently should also have surpassed in strength, that contemplated by Colonel Bomford; they being of the same calibre, and the proof to which this cannon was subjected was much more severe than what was proposed as sufficient by that experienced officer.

In view of all the circumstances thus briefly adverted to, but minutely detailed in the evidence which is spread upon the record, the court entertains a distinct and confident opinion, that, in originally forming the plan for the construction of large guns, Captain Stockton proceeded on well-established practical facts; that in coming to a decision upon the feasibility of the contemplated project, he did not rely upon his own theoretical opinions, but resorted to men of science and practical skill for advice, and that he was fully sustained by their judgment in every particular; that a series of experiments and trials with the two guns fully sustained the deductions of the gentlemen whose advice was sought, and justified the most assured confidence in the durability and efficiency of the gun.

In regard to the mode of loading and firing on every occasion, and emphatically that which was followed by the explosion, it is established by the fullest proof, to the entire satisfaction of the court, that every care and attention which prudence and professional capacity could dictate was observed. No shadow of censure, in this respect, can be attached to any officer or any of the crew of the Princeton.

In regard to the conduct and deportment of the captain and officers of the Princeton on the occasion of the deplorable catastrophe which occurred on the 28th of February last, the court feels itself bound to express its opinion that, in all respects, they were such as were to be expected from gallant and well trained officers sustaining their own personal character, and that of the service, marked with the most perfect order, subordination, and steadiness.

In conclusion, the court is also decidedly of opinion, that not only was every precaution taken which skill, regulated by prudence, and animated by the loftiest motives, could devise to guard against accident, but that Captain Stockton, Lieutenant Hunt, and Mr. King, the gunner, who had attended to and directed all the experiments and trials of these guns, exhibited only a due confidence in what they had witnessed, in placing themselves on every occasion, and particularly on that of the explosion, almost in contact with the gun, and in a position apparently not only more dangerous than any other, but that which might rationally have been deemed the only perilous situation on board the vessel.

The court, having thus completed its business, adjourned *sine die*.

March 11, 1844.

W. C. BOLTON, *President.*

Richard S. Coxe, *Judge Advocate.*

A.

Captain Robert F. Stockton having submitted to the President a request that a judicial inquiry may be instituted into the conduct of himself and officers in relation to the experiments and proofs which preceded the construction, and the proof and subsequent explosion of one of the great guns of the Princeton, occasioning the awful and distressing catastrophe which has recently occurred on board the said ship, the President, although he entertains the most perfect confidence that no censure can, with any show of justice, be imputed to either of the parties, yet has deemed it an act of justice to Captain Stockton to yield to his request. A naval court of inquiry is accordingly ordered to convene on board the Princeton, on Thursday, the 7th instant, at 4 p. m., with power, if necessary, to adjourn to some fitting place in her vicinity, for the purpose of investigating and ascertaining the facts in regard to the premises, and to report the opinion of said court on the matters thus referred to it. The said court will be constituted as follows:

President—Captain William C. Bolton.
Members—Captain Isaac McKeever, and Captain John H. Aulick.
Judge Advocate—Richard S. Coxe, esq.

By order of the President.

L. WARRINGTON,
Secretary of the Navy ad interim.

Navy Department, *March* 6, 1844.

B.

FULLER'S HOTEL, *March* 8, 1844.

SIR: I have the honor to inform you that a naval court of inquiry, convened at your request, by order of the President of the United States, is now in session at this place, and will to morrow morning at 10 o'clock proceed to examine testimony in regard to the experiments and proofs, and the circumstances attending the explosion of one of the great guns of the Princeton.

The court will either receive any communication which you may address to it on the subject, or, if you prefer to give your view in person or by counsel, will hear you orally.

Very respectfully, yours, &c.,

RICH. S. COXE,
Judge Advocate.

Captain ROBERT F. STOCKTON, *U. S. navy.*

C.

GADSBY'S HOTEL, WASHINGTON, D. C.,
Friday, March 8, 1844.

SIR: I have to acknowledge the receipt of your letter of this day's date, informing me that a court of inquiry has been organized at my request, to examine into my conduct in relation to the big guns of the Princeton, and the explosion of one of them on the 28th of February; and requesting to know whether I could attend in person, and, if not, by whom I desired to be represented; and whether I had any testimony or other matter to lay before the court. I regret to inform you that I am not able to attend the court in person, having not yet recovered from my wounds; and I should not have thought it necessary to have deputed any one to represent me, particularly, during the inquiry, but for the suggestion in your letter. I desire Mr. John R. Thomson, of New Jersey, may be permitted to act as my counsel in the matter before the court.

As the great object of the inquiry is to determine how much of skill and prudence has been displayed, or neglected, in the design and proof of the big guns, I desire most earnestly that every act of mine in relation thereto, from the first moment that I suggested the plan of the guns up to this time, may be spread upon the record of the court, without regard to any technical niceties. Having been informed that the officers and crew of the Princeton were mustered by order of the president of the court, and all those who know anything with regard to the matter have been ordered to attend as witnesses, I have no witnesses from the ship to name. But I wish to prove before the court that my experiments, with regard to the big guns, were not carried on, vainly relying upon my own knowledge and experience alone, but that, from the commencement to this time, I have been governed by the best lights afforded by the experience of others and the mechanic arts, as well as the advice and opinion of most scientific persons. For which purpose I desire that Mr. Francis B. Ogden, who I understand is accidentally in the city, may be examined, and that the enclosed letter

from Colonel Bomford may be admitted as evidence upon the record of the court.

Very respectfully, your obedient servant,

R. F. STOCKTON.

RICHARD S. COXE, Esq., *Judge Advocate.*

D.

WASHINGTON, *November* 25, 1840.

DEAR SIR: I hasten to acknowledge the receipt of yours of the 19th instant, and will furnish the answer with great pleasure as soon as time will admit; for the present, I must rely in degree on memory, and confine myself to a few condensed notes, which I hope will prove acceptable.

The weight and general dimensions of two ten inch (Columbiads) or chambered cannon, lately proved at South Boston, Massachusetts:

	No. 1, heavy.	No. 2, light.
Weight	17,600 lbs.	10,300 lbs.
To be reduced to	15,000 "	10,000 "
Charge, full chamber	18 "	12 "
Length from breech band to muzzle	106 inches.	106 inches.
Of chamber	12½ "	9½ "
Of cone or slope	5 "	5 "
Diameter of base ring	34¾ "	28¾ "
End of reinforce	29 "	23¾ "
Beginning of chase	27½ "	22½ "
Of chamber	7½ "	7 "
Plane of muzzle	18 "	14½ "

Gun No. 1 was proved with 22½ lbs. of gunpowder and one round shot; again with 18 lbs. of powder and one elongated shell, and ten rounds with 18 lbs. of powder and one spherical shell.

Gun No. 2 was proved with 15 lbs. and one solid shot; 2d, with 12 lbs. and one elongated shell; 3d, with 3 rounds of 12 lbs. of powder and one solid shot, and ten rounds of 12 lbs. of powder and one shell.

Subsequently, No. 1 has been fired 150 rounds with 18 lbs. of powder and one spherical shell; and No. 2, 50 rounds with 12 lbs. of powder and one spherical shell.

Note.—The solid shot weighed 125 lbs. each, and the spherical shells from 86 to 100 lbs.; the latter weight being required to insure the retention of the spherical form of the shell, the certainty of action and preservation of the fuse, and greater accuracy and uniformity of range.

The shot and shells were attached to a sabot or wooden bottom, the range or proof of the gunpowder 300 yards, and the weight of elongated shell 168 lbs.

Not being informed in relation to the weight and dimensions of your 12-inch gun, I cannot, of course, form an opinion in regard to the necessary proof; but with a 12 inch, which I designed in the proportions of No. 2, say 8 calibres in the bore, the relative proof would be, (the gun weighing 20,000 lbs:)

1st. 30 lbs. of powder and one round shot, weight about 220 lbs.
2d. 24 lbs. of powder and one elongated shell, weight about 270 lbs.
3d. 24 lbs. of powder (3 rounds) and one solid shot, weight about 210 lbs.
4th. 24 lbs. of powder (10 rounds) and one spherical shell, weight about 170 lbs.

Diameter of chamber, from 8 to 8½ inches, to contain a charge of 24 lbs. of gunpowder.

Wishing you every success in your experiments, which I deem of great importance, I remain, very respectfully,

G. BOMFORD.

Note.—The greatest range of gun No. 1 was at 35°, time of flight 28″, range 5,300 yards.

The greatest range of gun No. 2 was at 38°, time of flight 25″, range 4,400 yards.

No. 1 charge of powder, full chamber, 18 lbs. No. 2 charge of powder, 12 lbs., full chamber.

Captain R. F. STOCKTON, *U. S. navy*,
Princeton, N. J.

WAR DEPARTMENT, *April* 6, 1844.

SIR: In answer to so much of a resolution of the House of Representatives of the United States, of the 23d ultimo, as refers to this department, and requires the Secretary of War to inform the House what experiments have been made by officers under the direction of the department, for the purpose of testing the strength and utility of cannon manufactured from wrought iron, &c., I respectfully transmit, herewith, a report of the officer in charge of the Ordnance Bureau, to whom the resolution had been referred.

It is believed the report embraces all the information required, so far as it can now be furnished by this department.

Very respectfully, your obedient servant,

WM. WILKINS,
Secretary of War.

Hon. J. W. JONES,
Speaker of the House of Representatives.

ORDNANCE OFFICE,
Washington, April 5, 1844.

SIR: In reply to the resolution of the House of Representatives, calling for information as to what experiments have been made by officers of the War Department, for the purpose of testing the strength and utility of cannon manufactured from wrought iron; specifying such particulars as may tend to show the relative strength and utility of wrought and cast iron cannon; together with copies of all reports from ordnance or other officers on this subject, and such other information connected therewith as may be considered useful; as also the experience of European powers on this subject, and particularly the largest size to which wrought iron cannon for solid shot have been carried with success; and likewise the expenses of the experiments, and to whom the money was paid,—I have the honor to report

That the only experiments for the purpose of testing wrought-iron guns, recorded as having been made by this department, are the trial of two 6-pounder guns at Washington and Watervleit arsenals in 1832, and the experiment now in progress, but not completed, at Fort Monroe arsenal, with some guns of the same calibre.

In the experiment at Watervleit arsenal, the gun was fired twice with a proof charge, and forty times with service charges.

The band which held the trunnions slipped off at the 18th fire, and the firing had to be stopped to replace it. After firing the forty two rounds, the gun remained serviceable, but the enlargement of the bore was found to be as much as .04 inch, which is more than double that of the bronze guns now made. This enlargement of the bore is the greatest objection to bronze artillery, and would soon render a gun unserviceable; and, so far as this experiment goes, it tends to prove that wrought iron has no advantage over bronze in this respect, and consequently no greater durability. The particulars of this experiment, and of the mode of manufacture pursued in this instance, will be found in the report of Major Talcott, and the accompanying statement of the manufacturer, copies of which are enclosed herewith.

The trial at Washington arsenal consisted only in firing proof charges, which left the bore of the piece in a condition unfit for service, by opening the seams or welds.

By direction of the Secretary of War, some 6 pounder guns have been manufactured, in 1843, according to a new method, which is not divulged, at the same price as bronze guns, and promising to unite the advantages of wrought with those of cast iron. These guns are now at Fort Monroe arsenal, where experiments to test their strength and durability are in progress. They are not, however, completed; and although, of those tried, one failed at the 150th fire, by the trunnion band becoming loose, and another at the 450th fire, by the opening of the welds, the results, so far, are not sufficient to warrant a definite conclusion as to the merits of this mode of fabrication.

So far as it has been tested by this department, wrought iron has not proved a good material for the manufacture of field guns; and as the difficulty of fabrication increases with a greater quantity of metal, it is less suitable for those of larger calibre. The greatest objection, and apparently an insurmountable one, is the difficulty of welding the parts together perfectly, and the still greater difficulty or impossibility of ascertaining whether the welds are perfect or not. Besides, the effect of heating is to render the iron more porous, and of less specific gravity and tenacity; and, when often repeated, is known to destroy the good qualities of the best refined iron. When the bars are of small size, as in gun barrels, the hammering compresses and re-unites the particles, and corrects these defects; but in large masses, the effects of the hammer do not reach the interior of the mass, which is consequently left open and spongy, although the metal on the surface, and to a slight depth, is compact and fibrous.

The objects attempted to be gained by the use of wrought iron for cannon are—1st, lightness; and, 2d, strength.

1st. Reasoning from the successful use of that material for small arms, it has been supposed that a careful and skillful fabrication would effect these results. But lightness below a certain ratio is *not* desirable, it is positively injurious; for light guns can be used only with light charges. Field guns cannot be conveniently served when they have less than 150 lbs. of metal

to each pound of the shot, and battering guns require at least 200 lbs. of metal to each pound of the shot. With any less weight, the service of the gun is very difficult, from its excessive recoil; therefore, lightness is not a desirable point in the construction of cannon.

2d. Strength. As this is always desirable, it should be effected if possible, but not at the expense of any other important point. If it were possible to fabricate sound and strong guns of wrought iron, they would be found deficient in hardness. The projectiles used are of cast iron, a material much harder than wrought iron; consequently, the wrought-iron gun is soon indented and worn, so much as to prevent all accuracy in firing, and it then is worth little or nothing.

Leaden balls are used in small arms; but they are inadmissible in cannon, as the great heat of the exploded gunpowder melts the lead more or less, and changes the form of the ball, thereby reducing its range; besides, lead has not sufficient tenacity to enter hard substances, and therefore is not a suitable material to be used against ships and batteries. Wrought iron is also more liable to injury from rust, than bronze or cast iron; and the smallest crack admitting moisture would, of itself, in time, seriously injure the gun. The first cost of wrought iron cannon is the same as that of bronze, and more than six times that of cast iron. Bronze guns, it may be further remarked, after being too much worn for service, can be easily recast; whereas the old wrought iron is useless for refabrication, and of little value in such large masses for any purpose.

In regard to the experience of European powers on this subject, it may be stated, generally, that the use of wrought iron as a material for cannon has been attempted in Europe repeatedly, without success, from the invention of fire-arms to this time. The cannon of small size have succeeded better than larger ones; indeed, there is no known record of a wrought-iron gun for heavy shot proving satisfactory. The works of European writers on artillery abound in notices of wrought-iron cannon, of dates of manufacture extending back from the present century to the remotest periods of their use.

Frequent instances of accidents from their bursting are mentioned, and they have never been successfully manufactured on a large scale. Meyer, in his work entitled "Experiments in the Fabrication and Durability of Cannon, both Iron and Bronze," edition of 1834, says: "It is certain no experiment in artillery has been as often unsuccessfully repeated and abandoned as the fabrication of wrought iron cannon; and even at this time we are but little further advanced in it than at the beginning;" and Gassendi, in his "Aide-Mémoire d'Artillérie," edition of 1819, condemns the use of wrought iron for the manufacture of cannon entirely.

Herewith are submitted extracts from different writers, containing a chronological history of wrought-iron cannon, and remarks on the use of this material for their fabrication.

In regard to "the relative strength and utility of wrought and cast-iron cannon," the former having been already noticed, it may be stated in reference to the latter—

1st. As to the strength. Cast iron is of so many different qualities and kinds, and so variously affected by different modes of fabrication, that it is impossible to speak of the strength of cast iron guns *generally*. It is known, however, that, by careful attention to the selection of the metal, to its treatment in the furnace, to its proper distribution throughout the body of the

gun in relation to the force exerted on its different parts by the discharge, to its gradual cooling after being run into the moulds,—in a word, to all the manipulations connected with its manufacture; and by a judicious, moderate proof, serving to detect any flaws or imperfections which may have escaped observation during the manufacture, and not so severe as to strain or weaken the cohesion of the particles, cast-iron guns, sufficiently light for siege, seacoast, and garrison service, may be made, the use of which, with full charges, will be safe for at least 1,000 fires. But although the practicability of making good and safe guns of cast iron is believed to be an established point, it must be admitted that it requires a constant supervision and vigilance, which can only be obtained by means of a foundry under the entire control of the Government, or the employment of a skillful practical officer to attend at the private foundries during the whole process of fabrication.

2d. As to utility. In former times it was supposed that bronze only was suited for heavy guns, both on sea and land; and it was only after great advances had been made in the arts, that the maritime powers of Europe ventured to use cast iron guns on board their ships. The less cost and greater hardness of cast iron, therefore, have led to its use for artillery; and when it is considered that six or seven cannon of this material can be procured for the same cost as one of bronze or wrought iron, it will readily be perceived that, if we can fabricate them in such a manner as to render them safe for only one thousand fires, they should be adopted on the score of economy, and their accuracy of fire up to the period of their being laid aside; accordingly, all the European powers have fabricated their heavy guns, for ships and batteries, of this material—using bronze only for field and siege trains.

The British troops, in the Peninsula war, on several occasions found their siege trains of bronze speedily rendered unserviceable, and resorted to cast-iron guns; the superiority of which, over bronze, consisted in their greater accuracy, and being less heated in rapid firing; and they are stated to have endured 2,700 discharges. "These pieces had preserved such accuracy of fire, that in the last days of the sieges they were fired from a great distance over the heads of the besiegers at the breach, with sufficient precision to reach the besieged behind a high rampart."

The expenses of the experiments in wrought iron cannon made at Watervliet and Washington arsenals, consist only of the cost of the ammunition used in firing them, which was taken from that on hand at those arsenals. Nothing was paid for the guns. For the experiments now in progress at Fort Monroe arsenal, the expenses consist of the cost of the necessary ammunition prepared at the arsenal, and the price of the guns, ($2,100,) which has been paid to the manufacturer, Mr. Daniel Treadwell, of Massachusetts.

The resolution of the House of Representatives is herewith returned.

I am, sir, very respectfully, your obedient servant,

G. TALCOTT,
Lieutenant Colonel Ordnance.

Hon. WILLIAM WILKINS,
Secretary of War.

WATERVLIET ARSENAL, *May* 24, 1832.

SIR: Mr. Reuben Hunt, of Canaan, Litchfield county, Connecticut, has brought to this post a wrought-iron 6-pounder cannon, a drawing of which is enclosed herewith, together with a description of the mode of manufacturing the same. As it appeared by your letters of 22d August and 7th November last, which have been shown to me, that you were desirous of having his work tested and proved, and he not having the means of fully proving the gun, I have deemed it an object of sufficient importance to the Government to warrant my proceeding to prove and try it, without specific orders upon the subject.

The gun appears to be sound in the bore; some small flaws in the welding are perceptible, but no cavities of sufficient depth to injure it materially. It is not very smoothly bored, nor is it of the proper calibre; all which errors are believed to be within the reach of correction when the manufacture is undertaken on a proper scale, and with suitable tools. The exterior appears perfectly sound and smooth.

It was proved twice with 4 pounds of powder, (old powder, the best we have,) giving a range of about 250 yards, with the new eprouvette, two shots, and two wads, and was then fired 40 rounds with 1½ pound of powder, one shot, and one wad. At the 18th round, the gun slipped out of its trunnions, and it was then discovered that the band into which the trunnions were welded was put on very imperfectly, hardly touching the body of the gun, except at its upper and lower edges. A new band was made, and put on carefully; after which, the other 22 rounds were fired, without effecting any perceptible change; and it is believed that the gun, in its present condition, would stand service. Annexed to the drawing is a statement of the diameter of the bore before proof, and also its condition after all the firing was finished, by which it appears that a small increase or expansion has taken place. The iron seems to be of good quality, tolerably hard for forged iron, and the inequalities of the shot have made very little impression upon the bore—nothing like the effects that would be produced upon a brass gun subjected to the same trial.*

The gun remains here, subject to your orders. The expense of removing the band and trunnions, including labor, coals, and iron, was $21 22, which amount will be chargeable to Mr. Hunt, unless you should authorize the expenditure.

Very respectfully, I am, sir, your obedient servant,
GEO. TALCOTT, *Bt. Major, &c.*

Colonel G. BOMFORD,
Ordnance Office, Washington.

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*The comparative effects on the bore, here noticed, refer to the *bronze* artillery, manufactured prior to 1832, the date of the report; subsequent improvements in the manufacture of bronze guns have increased their hardness and durability; and it is with guns of the present fabrication that the comparison in the report of this date is made.
G. TALCOTT, *Lt. Col. Ordnance*

ORDNANCE OFFICE, *April* 5, 1844.

Method of manufacturing wrought-iron cannon by R. & S. Hunt, of Canaan, Litchfield county, Connecticut, in pursuance of a plan projected by their father, S. Hunt, as follows:

Take a piece of the best bloomed iron, made from wrought scraps, of such weight and size as will make a centre pin of such length as the size of the gun may require, and of such size as the calibre may require, so that there may be always three-fourths to one inch of the external surface of the piece left after boring, (as the gun is to be bored out of a solid mass.) The pin, as it is termed, may be either square or round, as may be most convenient to work. Then begin at any suitable place on the pin to weld on bars or pieces of the best wrought iron, roundways, till it acquires a suitable size with reference to the size of the gun; in this last operation great care should be taken to have good heats, and that no impurities get in to make imperfect places in the work, and thus form one solid mass of iron. It is then turned on the outside into any shape or fashion which may be desired, and bored out; thus forming a perfect wrought-iron cylinder in its internal appearance, and the shape of a cannon on the outside, having for its internal surface the grain of the iron lengthways, and its external surface the grain of the iron running roundways. A variety of ways may be pursued to fix on the trunnions—such as welding them on in the formation of the outside of the gun; or having them formed with a band, and shrunk on; or put on cold in two semi-circles; or they may be cast on, either of iron or brass, though the cast metal is considered of doubtful strength.

The gun offered for inspection was made at the same establishment, and of the same materials as the anchors well known in the navy as having been made by Russell Hunt & Brother.

REUBEN HUNT.

From Meyer's Historical Manual of the Technology of Fire-Arms, from their invention to the present time. Paris edition of 1837.

According to Vassius, the Chinese had, in the year 1055, cannon of bronze and wrought iron, which were worked with much skill.

A wrought iron cannon was found in the ruins of the castle *Uf Huger* on the Rhine, which castle was destroyed in the year 1308.

In the year 1338, the Teutonic order had three bombards of wrought iron.

At the siege of Eu, in 1340, the English had large wrought-iron pieces, with which they threw round stones.

According to Villani, the English, in 1345, had wrought iron cannon before Monségur. Darriel says that there are indications of the existence of wrought iron cannon and of powder at Toulouse at this time.

Siege of Claudia Fossa by the Venitians in 1366. Ligurius, speaking of this siege, says that some Germans came with two small wrought-iron pieces, firing leaden balls, which they offered to the Venitians, and that they used them with great advantage.

Description of the bombard by Redusius in 1427. It is of wrought-iron, and is composed of a straight bore behind, which widens like a funnel to-

wards the mouth; the forward or funnel-shaped part is eight calibres long, the rear part sixteen. In the straight part of the bore is placed an artificial mixture of saltpetre, of sulphur, and charcoal; the entrance is closed with a wooden tompion, on which, in the widened part of the bore, the stone bullet rests. This mixture is fired by means of a small aperture behind.

1439. Facius says that bombards are made either of wrought iron or copper; the two tubes, of which they are composed, being either run together, or joined to each other on the same stock.

In 1452, there was used before Oudenarde a wrought-iron cannon made of bars. It had a chamber containing 140 pounds of powder; its calibre was 22 inches; its circumference 10 feet 10 inches; its weight 33,000 pounds; it threw stone bullets or smalls casks filled with broken glass, scraps of iron, &c. It was called *Margot la Folle*.

In 1494, Charles VIII suppressed entirely wrought-iron bombards, and had no other artillery than that of bronze.

In 1544 mention is made of a wrought-iron piece used in the defence of St. Dizier; it weighed 6,831 pounds; was 8 feet 2 inches long, and it projected 8 cubic feet of stone at once.

There is at the museum of Paris a wrought-iron piece of 1555, very long, but of small calibre, with a movable breech.

In 1833, there were at Strasbourg several wrought iron cannon bearing the date of 1602; some of which were made to load at the breech.

1621. The cannon called *abraga*, are loaded by means of separate chambers. These pieces are usually of wrought iron, and of calibres as high as 100 pounders. Sarti saw some at Gand and at Amsterdam—one of which weighed 33,000 lbs.—where they were used principally on board of vessels. Venice has many pieces (50 pounders) of this kind on board of her galleys, where they are mounted on carriages. The chambers are of wrought iron or bronze—three for each piece. They are fixed in behind, by means of wooden wedges; at the moment of firing, those serving the gun stand on the sides.

In 1660, there was cast in India a large bronze cannon, with a wrought-iron bore of 6 inches diameter, weighing 7,726 lbs.

1661. There is at Berlin a wrought-iron piece of this year, for a two ounce ball, rifled with 13 grooves, with a screw breech, and a sight turning on a hinge.

There is now at Woolwich (1830) a wrought-iron piece, made at Nuremberg in 1694. There was at Zurich, in 1694, an old wrought-iron cannon composed of many pieces, easily separated from each other.

In 1697, there were made some wrought-iron pieces, composed of bars wrapped round a core. An 18-pounder of this kind burst at the first fire.

The wrought iron cannon made at Ocona, in 1744, stand well the proofs to which they are subjected. These cannon are now (1832) in the museum of Paris. They are of calibres of $3\frac{1}{3}$ and $2\frac{1}{2}$ inches; 5 feet 1 inch long. One of them weighs 210 lbs.

1747. Senner fabricates cannon of wrought iron, the bores of which are grooved, and the bottom of the bore movable.

1753. There is at the arsenal of Paris a handsome wrought iron 12-pounder, manufacture of Gentin, weighing 1,600 lbs. It was made solid, and bored out.

1764. There are at the arsenal of Paris 3 wrought iron cannon—one

12 and two 8-pounders. These pieces, made on spindles or cores, are composed of longitudinal bars covered with bands; the whole welded together.

1765. Anciola caused to be made at Pagaloga, in Spain, three wrought-iron pieces—one 4-pounder long, one 4-pounder short, and one 8-pounder. Bars of iron were used of $1\frac{1}{2}$ inch in thickness. These pieces forged solid, and afterwards bored and turned, sustained without injury the proof-firing, with charges of the whole weight and two thirds the weight of the ball. A royal order directed the fabrication in the same manner of two 24 pounder cannon, (weight 20 quintals—4,400 lbs. English,) two 16 pounders, (19 quintals—4,180 lbs. English,) and two 12 pounders, (16 quintals—3,520 lbs. English.) Some of these pieces were cracked in the proof. In one of these a new breech was put, and it stood proof. They were forged by hand.

There is at Paris (1830) a very handsome wrought-iron mortar, six and a half inches bore, weighing 220 pounds, and made in 1775, at Madrid, by Ortega. The collection at Woolwich contains a German wrought-iron piece of 1775.

Norbec saw at St. Sebastian, in 1780, wrought-iron cannon proved at that place in 1765, and which had remained since that time under an open shed. They were, he says, but little affected by rust.

1782. In France much interest is taken in wrought-iron pieces. Langevin has made two 4-pounders to the order of Marshal de Castries; and Bradelle, of Bordeaux, has made many for the owners of privateers, at the rate of 25 sous per pound.

1796. In France bronze artillery proves again to be of little durability. La Martilliere supposes that at the peace there will not be less than 1,410 of these cannon to recast, being completely unserviceable. He proposes to make, of wrought iron, small chambered pieces, such as are used at sea, to load at the breech.

1804. They manufacture in France wrought-iron pieces.

1810. The French find in Spain wrought-iron pieces, which the people of the country say had been used in the wars against the Moors.

1812. Fabrication of a wrought-iron 3 pounder at Gleiwitz.

1813. In France the company St. Etienne offers to deliver daily eight 24-pounders of wrought iron. An 8-pounder presented for trial sustains four fires with three pounds of powder, and five fires with four pounds. This piece appears to have been composed of bars wound round an iron tube, and joined with silver solder, and a screw breech. The cost of fabrication was not to exceed that of recasting bronze pieces.

1820. Professor Persy, in his "Notions on the Forms of Cannon," proposed to forge iron pieces on a core.

1828. Horton takes out a patent for wrought-iron cannon. The wrought-iron cannon made at Gleiwitz in 1812 is proved. It becomes much heated, and cracks; but sustains, notwithstanding, a great number of charges, with ball, and a charge of powder half the weight of the ball.

1830. A cannon made of bar iron wrapped spirally, and soldered with copper, does not sustain the proof-fire.

From "Experiments on the Fabrication and Durability of Cannon, both Iron and Bronze," collected and arranged by Moritz Meyer; Paris edition of 1834.

It is certain that no experiment in artillery has been as often unsuccessfully repeated and abandoned as the fabrication of wrought-iron cannon; and even at this time we are but little farther advanced in it than at the beginning. It is known that the cannon which were called bombards, were composed of bars of iron, held by circles, like the staves of a cask; shortly after, they were brazed together. At this time their chief use was to fire against cities; and as there was, consequently, little need of accuracy of fire, and the powder was weak, and the projectiles of stone, these clumsy and badly-made machines were sufficient; they did, however, frequently burst; as, for example, at the siege of Constantinople by the Turks, where a bombard firing stone projectiles of 480 kilogrammes (1,056 pounds English) weight, burst at the first fire, and killed many persons. James II, King of Scotland, was killed at the siege of Roxburgh, in 1460, by the bursting of a bombard. Ancient writers, such as Miethen, Sardi, &c., relate that wrought-iron cannon frequently burst in rapid firing.

Subsequently, cannon seem to have become more defective, as the artillery corps became better instructed. Guns of large calibre were abandoned, which facilitated the fabrication; but, at the same time, greater exactness was required, and cast-iron balls were introduced; a greater number of pieces were used, and the firing was more rapid: whence the fabrication, already defective and difficult, became more so. It was then increased by the introduction of trunnions. But, in consequence of the great uncertainty of the results of the different welding heats, which often burnt the metal in some of its parts, the fabrication of wrought-iron cannon was abandoned in the middle of the fifteenth century, for the introduction of cast iron. Nevertheless, reckoning on the progress which had been made in the art of metallurgy, it was resumed in later times, with the hope of overcoming the difficulties which had formerly been regarded as insurmountable. Thus, in the 16th and 17th centuries new experiments were undertaken, but after a new method. Massive cannon were forged by means of *skelps* suitably prepared. The archives of the arsenal of Paris mention a 12-pounder wrought iron cannon, weighing 1,600 pounds, made in this way in 1753. There are to be seen at the museum of the artillery school of Strasbourg, four wrought-iron pieces, weighing from 90 to 100 pounds; one of which bears the date 1601.

At the commencement of the last century, new attempts were made in France to introduce the manufacture of wrought-iron cannon by a new process. It was proposed to envelop them with solid bands. A very high price was asked for cannon made in this way, under the pretence that they must offer great advantages, because the direction of the fibre of the iron was perpendicular to the axis of the gun, where the greatest strain from the ignited powder was exercised.

St. Remi, in his Memoirs, mentions the process followed on this occasion; but he adds, that, notwithstanding the assurances of one of the manufacturers on the excellent quality of an 18 pounder, which he presented, it *burst at the first fire into two pieces, and killed and threw into the Seine many persons.* He also mentions a wrought-iron cannon composed of seven pieces, which offered the advantage of easy transportation; but he adds, that it burst into small pieces at the proof. In 1745 several

wrought iron 8 and 4 pounder cannon were tried at Toulon. They resisted charges of six and four pounds of powder. After several discharges, one of them (an 8 pounder) began to crack; but, notwithstanding, it still stood many fires; and it was not broken in pieces but with much trouble, and after using powerful means.

In the present century, though not far advanced, much ingenuity has been exercised on this unfruitful subject. But although more light has been thrown on it than in the preceding century, we have not yet succeeded in satisfying the requirements of artillery.

The experiment which has succeeded best, took place in France in 1813. The company *Etienne* offered to the Government a wrought-iron 8 pounder, weighing 800 lbs., which, according to Gen. Gassendi, (page 784, 5th edition,) had the bore forged in the same manner as a musket barrel, (similar ones had already been proposed before;) the bore was closed by a screw breech. This cannon sustained 4 fires with 8 lbs. of powder, and 3 with 5 lbs. This company engaged to deliver 24 pounders, which should not cost more than bronze guns of the same calibre. In Silesia they have forged many cannon of a single piece, but which have not given satisfactory results. We have seen two cannon which were wrought in a German shop, and which were formed of twisted bands of iron, but they broke to pieces in the proof. At the Carron works in Scotland experiments have lately been made on pieces composed of iron bands, and an Englishman has taken out a patent for it, but the results are not known abroad.

* * * * * * * *

An objection to wrought-iron guns, which appears much more serious than liability to rust, arises from the great difficulty experienced in their fabrication on a large scale, which permits the doubt whether it can ever furnish a supply sufficient for all wants. When we consider the difficulty experienced in finding plates for musket barrels free from defects, even when they have been prepared with care—and even after that, how many of these barrels are filled with flaws and cracks; when we know how difficult it is to weld together pieces of large dimensions, without leaving some places of imperfect junction, which may afterwards permit the rust or the fire to penetrate; how difficult it is to discover this defect by proof or otherwise; and, finally, how negligent the workmen, and how inattentive even the overseers in the shops are,—it must be admitted that a wrought iron gun, which ought to undergo the most rigorous proof, would not, even if it should therein prove perfectly satisfactory, afford all the necessary guarantees; and the success of no one would warrant the adoption of their manufacture on a large scale.

* * * * * * * *

Wrought iron (as a material for cannon) fulfilling the requisite condition of tenacity, has naturally attracted attention. The difficulty of fabrication has not stopped some manufacturers. It seems, indeed, that this obstacle is susceptible of being overcome; and that it has been, as is proved by the wrought iron guns which exist at present, and some of which date back to very remote periods. Besides, working in iron has in late times made great progress; and there is reason to believe that if a reward and a large order were secured to him who might present a wrought-iron cannon of sufficient strength, a manufacturer, at reasonable prices, would quickly be found. But the condition of resistance to the explosion of powder is not the only one to be fulfilled. It is also requisite that the bore of the guns should re-

sist the pressure and the ballotting of the balls. For many experiments prove that lodgments of the balls are often formed in the bores of wrought-iron guns, so quickly as to leave doubts as to the great advantages which many authors have attributed to this kind of cannon.

From Gassendi's Aide Mémoire: Paris edition of 1819.

But these wrought iron pieces, and others like them—are they good? ought they to be adopted? No. Because—

1st. They soon destroy the carriage, by the suddenness and length of the recoils.

2d Because of the serious inconvenience to those serving the pieces, from the length of the recoil.

3d. On account of the alteration in the ranges, by the continual and inevitable oxidation of the bore.

4th. The moral effect on the gunners, from the fear of their bursting.

In fact, these pieces often burst, although the first which are presented by the inventors for proof do not always do so, because they use for them selected metal, and carefully watch their fabrication. But, in making a number, is it to be hoped that the metals will be as scrupulously selected, and that an observing and practised eye will watch over the degree of heat which the metal ought to have in order to work solidly the immense number of welds necessary to finish the piece; then, from firing, the imperfect welds will be imperceptibly opened; moisture will penetrate the fissures, which, increasing to a certain extent, will cause the gun to burst; exfoliations will be formed in the bore, which will retain fire and cause accidents. Finally, the irremediable oxidation of the bore in time of war will so enlarge it, as to render the guns unserviceable, and in time of peace there will be the trouble of keeping them constantly painted to prevent this oxidation. We have been thus profuse on the defects of these pieces, to answer, once for all, an innovation which appeared good, and which is often represented as something new.

Mr. Rhodes, a very skillful and practical naval constructor, who was employed for some time by the Turkish Government, states that there are in the arsenal at Constantinople many wrought iron cannon of calibres varying from 100 pounders to the smallest sizes. These guns have all been thrown aside, and are no longer considered as suitable for service. By direction of the Sultan, some of them have been cut up, both in cross sections and longitudinally, to ascertain the manner of their fabrication. They were found to be composed of bars surrounded by bands, like the staves and hoops of a cask, the whole welded together—those of larger size being formed on a *mandrel*, and the smaller ones forged solid and bored out. They were composed of successive series of these bars and hoops, laid on each other to make the requisite thickness of metal, and the junctions of these layers, as also of the bars and hoops of the same layer, were distinctly perceptible. The defects were enlargements and batterings of the bores, arising from the effects of the charges on the soft metal composing the guns.

Respectfully submitted:

G. TALCOTT,
Lieutenant Colonel Ordnance.

ORDNANCE OFFICE, *Washington, April* 5, 1844.

NAVY DEPARTMENT,
April 17, 1844.

SIR: I have the honor to transmit a report from the Bureau of Ordnance and Hydrography, with the papers therein referred to; prepared in compliance with a resolution of the House of Representatives, passed on the 23d ult., in relation to wrought-iron cannon.

I have the honor to be, very respectfully, your obedient servant,

J. Y. MASON.

Hon. JOHN W. JONES,
Speaker of the House of Representatives.

BUREAU OF ORDNANCE AND HYDROGRAPHY,
April 2, 1844.

SIR: In reply to your letter of the 28th ult., transmitting a call from the House of Representatives, for information respecting the strength, utility, and cost of wrought-iron cannon; and the result of the experience of European powers on the subject, which may be in the possession of this bureau,—I have the honor to submit the accompanying papers, marked from Nos. 1 to 4, viz:

No. 1.—Captain R. F. Stockton's report of his gun-practice with his wrought-iron gun at Sandy Hook.

No. 2.—Report of inspection of the first gun, by Commodore Wadsworth.

No. 3.—Captain Stockton's report of proof of gun.

No. 4.—The cost of each of the wrought-iron guns, made under the superintendence of Captain Stockton, so far as paid for by this bureau.

Our information in relation to wrought-iron cannon is very scanty. Tousard tells us, in a note to page 190, vol. 1st, Artillerist's Companion, that, "in 1776 an iron gun was forged by Mr. Samuel Wheeler, an eminent artist, still living (1809) in the city of Philadelphia. It was intended, at first, as a 4-pounder; but was only bored for a 3-pounder. This gun was taken at the battle of Brandywine, and is said to be now in the Tower of London." I believe this is the only gun of which we have any record in this country, as having been used in actual warfare, and, as it appears, with success. The next account of the manufacture and proof of wrought-iron guns in this country, is found in the report of a board of officers of the army, as follows:

"A 6-pounder wrought-iron gun, manufactured by R. and S. Hunt, anchor-makers, was tried at Watervliet arsenal in 1832. This gun was fired 2 proof charges, and 40 rounds service charges. At the 18th fire, the band which held the trunnions slipped off, and had to be replaced. After the 40 rounds, the gun still remained serviceable. The greatest enlargement of the bore was found to be 0.04 inch—which is more than double that of any of the brass guns proved lately; from whence we may infer, that, if all difficulties were overcome, and a complete iron gun made, it would have no great advantage over bronze, as regards its durability. It is understood that these same manufacturers failed in making other wrought-iron guns.

"Although a proof gun can be made when the metal is selected with great care, and the fabrication carefully watched; yet, in fabricating them on a large scale, it will be impossible to take the precautions necessary to

insure the perfectness of all these numerous welds. The smallest crack would contain moisture, which would produce oxidation; and this would, in time, destroy the gun. The board do not think it necessary to incur further expense in testing this material."

Again, says this report: "Guns of this material (wrought iron) were the first used; and they have been tried, at various periods since the first invention of gunpowder, and always without success.

"The first and greatest objection is, the difficulty of welding the parts together perfectly, and the still greater difficulty of determining whether the welds are perfect or not. In the account of a wrought-iron gun, tried at Toulon in 1745, it is stated, that, after the gun was broken up, the cascabel and trunnions were found to be held only by a portion of the faces which touched. Three-fourths of these faces showed the effects of rust."

It appears from most authorities, that the art of casting guns was esteemed a great improvement upon the more ancient art of forging them, and, whatever may have been the cause, immediately superseded the latter. The cause may have been the vastly diminished cost of the cast-iron guns, or the facility of manufacture, or the opinion of greater security and certainty in the use: or, probably, the combination of all of these. Certain it is, that the forged guns went entirely out of use.

Several accounts of these forged iron guns are given by writers on artillery. Tousard says, page 168, vol. 1: "There are at present (1809) on the ramparts of Narbonne, two old pieces, composed of iron bars, applied lengthwise, and encircled with strong iron hoops transversely; the whole soldered together. They are not much altered, although they have been neglected for a long time; but the rust has injured them most in the points of junction, and made these more apparent. It is probable that if, at the time when they were made, the arts had been as far advanced as they are at present, they would still be fit for service."

"New attempts have lately been made in France, at Guerigny, department de la Nievre, and in Spain, at Caveda, New Castile, to construct such guns; and they have been crowned with success. But, at first, when compared with cast-iron guns, a wrought-iron heavy ordnance would have been attended with considerable expense, as well from the price of metal, as from the attention which their fabrication requires; and, secondly, the enormous consumption and want of cannon at that time (1794) compelled a recurrence to the most expeditious and least expensive proceedings—therefore, to confine their fabrication to cast iron. However, they are not half as expensive as brass guns."

It may be remarked here, that Tousard was strongly in favor of experimenting upon wrought-iron cannon, with a view to their introduction into the service of the country. He observes, however, of cast iron, "that if it was by some means possible to produce a more perfect melting of the iron, cannon cast of this metal, with an equal thickness, would be stronger, more durable, and lighter than brass cannon." (page 198.) He gives the preference, however, to brass cannon, because "the service of which should present more security."

Grose, in his Military Antiquities, vol. 1, page 381, says that cannon "were in general constructed of iron bars, soldered or welded together, and strengthened with iron hoops; others were made of plates of iron rolled up, and fortified with iron hoops." He speaks of several "at Woolwich—one

belonging to ——— Pooley, esq., in Suffolk;" and "also several of those hooped guns in the Isle of Man, England." Bombards were at first chiefly made of hammered iron; but, in process of time, many were cast of that composition named bell or gun metal. They were also sometimes made of plates of iron and copper, with lead run between them. One of these guns was taken up on the coast of Ireland.

That wrought iron guns, constructed of iron bars hooped together, were used very generally, we know from the specimens yet preserved, and the facts of history. James the Second of Scotland lost his life before Roxburgh castle, by the bursting of one of these guns. In 1545, a man-of-war, named the "Mary Rose," commanded by Sir George Carew, sunk off the Isle of Wight, with her whole crew. 300 years nearly after the accident, Mr. Dean, with his diving apparatus, raised a 24 pounder brass gun, and, at the same time, some iron guns. The iron guns were formed of iron bars, hooped together with iron rings; and they were all loaded, &c.— *Wilkinson's Engines of War.*

"In 1813, a company of mechanics of Lyons, named the 'Etienne Company,' proposed to the French Government to manufacture all the guns wanted, of forged iron. They sent to Paris a specimen 8 pounder, weighing 570 lbs. It was mounted upon a truck carriage, with solid wheels, 17 inches in diameter, and fired with 3 lbs. of powder. The recoil was 25 feet; with 4 lbs of powder, it was 37 feet. The gun sustained nine rounds without injury; but the material was not approved by the French officers. Other pieces of the calibre of 16 and 24 were made; the mode of fabrication seemed to be thus: Upon a tube formed after the manner of a common fowling-piece, or gun barrel, bands of iron were welded, embracing the tube, but in a direction contrary to that of the fibres of the tube, until the requisite size and strength were obtained. The gun was bored out to the proper calibre, and the breech-piece screwed in and soldered to its place by silver solder, which was esteemed the best. The different bands of iron were welded to each other, and to the tube, by blows from the hand hammer.

"The inventor proposed to employ in the fabrication of 24-pounders, &c., bars of iron 12 feet long by 1 foot 8 inches, which, forged out into skelps, and converted into bands thinned off at the sides, were welded together over a mandrel, under blows of a trip-hammer. The trunnions were welded to one of these bands. The bars used were twisted; and they believed that, as the small arms manufactured were excellent, this process augmented the tenacity of the metal by a fourth; and this was their secret.

"But extending the manufacture on a great scale, could we hope that the metal shall always be scrupulously chosen, and that a practised and observing eye shall always watch over the degree of heat which the metal ought to have, in order to work to a uniform solidity the prodigious quantity of welding necessary to perfect the piece? When the gun is fired, the imperfect weldings will open imperceptibly, and the damps will penetrate the fissures, which, after a time, will cause the gun to crack, and form within the bore leafy exfoliations, which, retaining the fire, will occasion accidents. In short, the irremediable oxidation of the bore in time of war will so enlarge it, as to throw the piece out of service; and in time of peace they would require frequent painting to prevent this oxidation."

"The objections to the wrought iron gun are continued thus:

"1st. They promptly destroy the carriages, by the suddenness and extent of the recoil.

"2d. They incommode greatly the troops, by the length of the recoil.

"3d. They will change their range greatly, by the continued and inevitable oxidation of the bore.

"4th. They enfeeble the moral of the cannonier, by the continued apprehension of their bursting.

"In fact, these guns often burst, although the first pieces furnished by the company for proof did not always burst. We have thus dealt at large upon the defects of wrought iron guns, in order to reply, once for all, to the pretensions of an invention which claims to be good, and is often represented as new."—*Aide-Mémoire*, vol. 2, page 784, &c. Paris, 1819.

Some of the Spanish writers speak of wrought-iron guns: thus, Ciscar, in his Tratado de Artilleria, Madrid, 1829, says: "We do not owe the information that wrought-iron cannon of all descriptions formerly existed, to the Chevalier d'Arcy alone, but also to many writers. Texier de Norbec, amongst others, treats at length of various guns of this kind. From 1666 to 1694 there was one in the arsenal of Zurich, in Switzerland, of 24 pound calibre, the constituent parts of which admitted of being dismounted and replaced at pleasure."

"In the arsenal of Paris are found two pieces—one a 12-pounder, and one an 8 pounder—constructed of tubes one within the other, secured by strong bands, and the whole welded together; and I am assured that we have in our own establishments two wrought-iron guns, light, and of perfect workmanship."

"At the chateau of St. Dizier a very old piece was found, of a calibre of twenty inches, and weighing 7,616 lbs.; the chase was made of wrought iron, and the chamber and breech cast of the same metal. At Hartz, also, were some pieces, 12 and 16 pounders, of wrought iron, which do not appear to have been fabricated in the usual manner, with bars and bands welded together, nor is the process known; they weigh about 8,000 lbs."

Again: "At Brest is a cannon taken from the English, weighing 7,723 lbs., 11 feet 1 inch long, and of 6-inch calibre. The bore is made of seven bars of wrought iron, secured by bands of the same metal."—*Aide-Mémoire*, vol. 2, p. 784.

It appears that wrought-iron guns have been made from the earliest times, and were, until superseded by the introduction of cast-iron and bronze cannon, the principal artillery in use; that at different periods since the general use of cast guns, efforts to construct serviceable cannon of wrought iron have been made by the principal European powers; and that, whatever may have been the cause, they have not been again employed in active warfare. The inference is, therefore, although no further information than the foregoing is in the possession of this bureau, that they have not been used for good and sufficient reasons.

The two wrought iron guns on board the steamer "Princeton" being the only guns of that description ever used in the navy, no opportunity has been afforded this bureau of ascertaining the relative strength and utility of wrought and cast iron cannon.

All of which is respectfully submitted.

I have the honor to be, very respectfully, sir, your obedient servant,

W. M. CRANE.

Hon. JOHN Y. MASON,
Secretary of the Navy.

No. 1.

PHILADELPHIA, *December* 23, 1842.

SIR: In accordance with your instructions, I will have the honor to transmit herewith "a detailed statement of the practice I have already had with the wrought iron 12 inch gun; the effects of firing on the gun, and its present state and condition; the ranges of the shot, strain on the gun-carriage, and the recoil," &c.

Having proposed this new gun, and having suggested the necessity of the experiments, the particulars of which I am now to detail for the information of the department, it may not be considered impertinent to take a brief notice of the art of gunnery, to show its inapplicability to practical results generally, and especially to the practice with the wrought iron gun of 12 inches diameter and 212-lb. shot. The formula laid down in the books on the art of gunnery being in most cases empirical, (although they may express the facts with regard to the motions of shot of nearly the same size,) are inapplicable to the present experiments; giving, in most cases, results differing widely from the true observed results. The calculations most relied upon, and from which the rules of gunnery have been deduced, were based upon the supposition that the ball passed through a vacuum; and therefore it is that many of the practical rules deduced from them are erroneous. For instance: it is calculated that the curve which is made by the flight of a ball through the air, is a parabolic curve. It would no doubt be such a curve, if the ball moved through "free space;" but the resistance of the atmosphere foreshortens it within a circle. Hence the necessity of a new series of experiments, to show the difference in the flight of a 212 lb. ball and a 42-lb. ball; and to prove that, I have heretofore, and do now, insist on it, that *the larger and heavier the ball, the greater the range, and the greater the accuracy of firing.* (See tables D and E, and plate 1, fig. 5.) Again: the rule laid down in books on gunnery that I have seen, make the initial velocity of the shot directly as the square root of the weight of powder, and inversely as the square root of the weight of the shot. Now, taking the velocity of a 24 lb. ball, with a charge of 8 lbs. of powder, at 1,339 feet per second, (see "Sir Howard Douglass on Gunnery," page 132,) and deducing the velocity of a 212-lb. shot with 25 lbs. of powder, according to the above rule, it will give an initial velocity of 796 feet per second; whereas the true velocity was found, by actual experiment, to be more than 1,100 feet per second.

Before the experiments were commenced, the wrought-iron gun was proved by a charge of 35 lbs. of powder, the strength of which was more than 40 yards greater than "navy proof," and with one shot of 212 lbs.

The first experiment was designed to ascertain the destructive effects of a shot of 212 lbs., and the accuracy with which it could be propelled from the wrought-iron gun; the distance of the target from the gun being 557 yards, and the gun ten feet above the level of the ground. For these ends, 8 shots were fired at the target from this gun. By referring to plate 1, fig. 2, you will see the place struck by each shot, and the surprising accuracy with which they passed through the target. Plates Nos. 2 and 3 will exhibit the extraordinary effects of *two* of the shot upon the target, which was made to represent a section of the two sides and deck of a 74-gun ship, timbered, kneed, planked, and bolted in the same manner that a ship of that class is.

The next experiment was intended to make a comparison between the wrought and the cast gun made for that purpose. By referring to table A,

and to plate 1, fig. 3, you will see that the wrought gun was much superior to the cast gun; that the wrought gun sent every shot with great precision and certainty, and that the cast often missed; that the wrought sent the shot with unerring aim directly at the target, and that the cast gun was irregular and often wide of the mark. The average distance that the shot fired from the wrought gun passed from the vertical line through the centre of the target, was two feet three inches—never varying more than 7 feet; while the average distance that the shot from the cast gun passed from the same line was nearly thirteen and a half feet, varying sometimes 40 feet.

This target having stood the fire of two years' previous experiments, with shot and *shells*, it was thought important to see what the effect of a few more 212-lb. shot would be upon it. It was soon destroyed. I am informed that the naval constructor at New York was sent down by Captain Perry to examine it, that it might be repaired; and that he reported that it could not be repaired—that it was "*cut in two.*"

Having destroyed the first target, and having proved the undoubted superiority of the wrought, over the cast-iron gun, the next experiment was made to try the accuracy of the wrought gun at a greater distance, and with greater charges of powder, (see table B;) for which purpose the strongest remaining target was selected. This target was 910 yards (more than half a mile) from the gun. It is 32 inches thick, made of oak and hard pine, fastened about every nine inches with screw bolts $1\frac{1}{2}$ inch in diameter. It had successfully resisted all previous firing with shot and shells, and escaped, as far as I can learn, any serious injury. We found pieces of shells between the timbers, which appeared to have burst there, doing but little mischief. By referring to plate 1, fig. 4, you will see where each shot passed through the target. Of the eight shots fired at it, seven struck it, and one, falling short, struck an inclined sand-bank, and bounded over the middle of the target.

The strength of this target induced me to endeavor to cut it through horizontally, and you will observe that six out of the seven shot that hit the target struck the same plank; a degree of precision and effect which I will venture to affirm has never been equalled by any other gun. We desisted after eight shots had been fired at it, for fear of destroying it entirely.

Being quite satisfied as to the accuracy of the wrought-iron gun, and the destructive effects of the shot, the next experiment was made to ascertain whether a wrought-iron target $4\frac{1}{2}$ inches thick could be penetrated by shot. A target was made, similar in all respects to the one made by Mr. Stevens, and fired at in presence of Commodore Stewart and other officers. The cast iron gun was first tried, and, with a charge of 35 lbs. of powder, it burst, as you have been informed by a previous report.

The wrought-iron gun was then fired at it with a charge of 25 lbs. of powder, and one shot of $212\frac{1}{2}$ lbs., which struck it nearly in the centre, and passed through it, and 5 feet into a sand bank.

The next experiment was made with a view to find the initial velocity of, and the true curve made by, the ball in its flight through the air—facts and principles connected therewith, upon which rests, in my opinion, the whole art of gunnery, and which, so far as I know, have never been satisfactorily ascertained, either in this country or in Europe; and with the aid of which, I think a table may be made, not to occupy more than two leaves of the signal book, by which a commander may direct at a fort every gun in his squadron with unerring certainty.

For this purpose, the experiment with the 12 screens (which I have before described to you) was instituted, which you will see, with its results, as far as they could be ascertained, by reference to plate 1, fig. 6.

Having got, as far as stated, the velocity and the curve made by the ball, the next experiment was to fire at long ranges by a table of angles calculated, from the above results, to show how near we had arrived at any certainty in this important art. With this object in view, we fired one shot with the calculated angle for 440 yards, (see table D,) and struck very near the spot expected. The precise spot could not be ascertained, as the tide was up on the stakes some three feet. The next day came on a severe storm; and the weather being very cold, and the officers and men much exposed, I suspended operations for the season, as you have already been informed.

These experiments ought, in my opinion, to be repeated under better circumstances. The weather was so bad, and the wind so high, that the screens were disturbed and broken before we could get the measurements as accurately as they ought to be obtained.

Nothing has heretofore depended more on the blind chance of fortune than a sea fight. I have endeavored to reduce the art of gunnery to something more certain in practice, and more satisfactory in science. Considering the means at my disposal, something, in my judgment, has been accomplished. I only ask you to compare the plan adopted for these experiments, the expense and the results, with any others that have been made; and say whether another gun should not be at once put in hand, and all other appliances prepared as soon as possible, so as to confirm what has thus far been developed.

The wrought-iron gun was strengthened by bands shrunk on after the gun was made. In consequence of two of these bands having been put on too tight, they have cracked by the jar of the explosion. I will have one of them taken off, that Commodore Wadsworth may see how perfect the gun is under them, and will have others put in their place.

I have now only to inform you that the gun is as perfect, in every respect, as when the experiments commenced—not having, as far as I know, a single scratch inside of the bore. The new wrought-iron carriage answers in all respects well; it has not been in the slightest degree injured, and its recoil (as you will see by table C) has never been more than 3 feet.

The gun can be loaded and managed almost as easily as a 42-lb. gun on the lower deck of a 74-gun ship.

Supposing that, from the great surface of a 212-lb. ball, the ricochet would be more regular and important than that of any other shot, I made the following experiment, which, in copying this report, has been omitted in its proper place. A target only 8 feet square was anchored one mile from the gun, and the gun fired at it with a depression of half a degree. The shot never rose more than 10 feet above the water, and passed through the target as shown in plate 1, fig. 1.

It was intended to have tried longer ranges, both at ricochet and by direct shots; but, owing to the roughness of the sea, and the high winds, we had not the means of securing, for a sufficient length of time, the targets at sea; nor were there ranges of sufficient length on shore.

I am, sir, very respectfully, your obedient and faithful servant,

R. F. STOCKTON, *Captain U. S. N.*

To Com. Wm. M. Crane, *Bureau of Ordnance.*

EXPLANATION OF PLATES.

Explanation of Plate I.

Fig. 1 shows the path of the ball, and the manner of striking the target (of only 8 feet square) at the distance of one mile.

Fig. 2.—Elevation of the timber target represented in Plates Nos. 2 and 3, showing the position of the eight shot fired from Captain Stockton's wrought-iron gun as they struck the target—numbered in the order in which they were fired.

P, P. Painted to represent port-holes of ship.

The average distance of the points passed by the shot from the central *point* of the target is $5\frac{3}{4}$ feet, or from the central *line* $3\frac{1}{4}$ feet.

N. B.—The above shot are all that have yet (September, 1842) been fired from the wrought-iron gun.

Fig. 3 illustrates the result of a comparison made between the wrought and cast gun. (See table A.)

Fig. 4 shows the manner in which the shot struck the target 910 yards from the gun. (See table B.)

Behind and within one hundred feet of this target, there was, at the close of the firing, no place large enough for a man to stand upon, which was not covered with splinters and fragments of the iron bolts.

Fig. 5 shows the path of a 42-pound shot, as near as can be ascertained from the discordant tables of ranges to be found in books of gunnery; and the path of a 212-pound shot, fired with 25 pounds of powder, according to the column of ranges in table D.

Fig. 6 shows the firing through 12 canvass screens, 30 yards apart.

The curve made by the ball in passing through the screens was very nearly (a little within) an arc of a circle of 36,000 feet diameter. Taking this experiment in connexion with the other firing, it is found that the ball describes a curve, whose deflections from a tangent are as the 2.10th power of the distance from the gun. The initial velocity is calculated to be 1,137 feet per second.

According to the table of ranges in Sir H. Douglass, a 42-pound ball describes a curve, whose deflections from a tangent are as the 2.50th power of the distance.

Owing to the rise of the tide before the experiment was completed, and the roughness of the water, it was impossible to get accurate measurements. It is very desirable that this experiment should be repeated in calm weather, and the measurements made with great precision.

Explanation of Plate II.

A, A. Sides of the ship, of solid oak, 30 inches thick.
B. Hole made by the ball, 3 feet by 3 feet.
C. Timber, 10 by 12 inches, 8 feet long, drove in by the ball—8 bolts, 20 inches, being drawn.
D. Stick of timber, 9 by 11 inches, 3 feet 9 inches long, secured by 7 bolts, torn off and carried 45 feet from B.
E. Part of the lining-timber from B, containing two 20-inch bolts, carried 45 feet.
F, F. Splinters from B, carried from 70 to 80 feet—one 7 feet in length.
H. Indentation through live-oak knee, and into timbers, 15 inches deep, produced by the ball.
J. Position of the ball after rebounding.
K, K. Iron bolts, 21 inches long, 1 inch to $1\frac{1}{4}$ inch in diameter, torn out of the timbers and bent, as shown.
L, L, &c. Upwards of 80 splinters of various dimensions, torn from the ship's side, and scattered, as represented.

Explanation of Plate III.

A, A, A. Path of the shot.
B. Hole in the ship's side next the gun.
C. Hole in the ship's side farthest from the gun.
D. Timber, 8½ by about 11 inches, upwards of 20 feet long, thrown round at right angles, 38 bolts being drawn.
E, E, E. Fragments from 150 pounds weight down to the smallest size, covering the ground for 40 or 50 feet from each hole.

The shot, after passing through the second ship's side, continued on its course, and made several ricochets on the marsh beyond.

Whole thickness of timber passed through by this shot, 57 inches.

A.

Table comparing the firing with the two guns at a target

CAST-IRON GUN.

Charges of powder.		Elevation.	Distance at which first struck.	Shot passed from vertical line on target.		From tangent to point first struck.	General velocity.	Radius of circular arc described.	Time of flight.
Lbs.	*Yards. proof.**	*Deg. min.*	*Yards.*	*Right.*	*Left.*	*Feet.*	*Feet per second.*	*Feet.*	*Seconds*
14	–	2 7½	490	12 ft.	–	64	685	16.887	2.00
14	–	2 7½	500	–	18 ft.	67	732	16.800	2.05
14	–	2 10	557	12 "	–	72	788	19.390	2.12
14	–	2 10	550	12 "	–	72	778	18.975	2.12
14	–	2 10	557	3 "	–	61	857	22.887	1.95
14	–	2 10	500	–	40 "	67	732	16.800	2.05
14	–	2 10	500	–	3 "	67	732	16.800	2.05
14	–	2 10	557	12 "	–	59	870	23.663	1.92
14	–	2 12	557	–	3 "	59	870	23.663	1.92
14	–	2 12	557	–	8 "	68	811	20.531	2.06
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–
20	–	1 30	557	2 "	–	38	1,092	36.740	1.53
20	–	1 40	525	–	30 "	56	842	22.148	1.87
20	–	2 0	557	14 "	–	60	865	23.268	1.93
20	–	0 0	290	–	30 "	13	967	29.111	0.90
20	–	1 0	300	–	4 "	21	790	19.285	1.14
20	–	1 0	400	12 "	–	34	828	21.176	1.45
				79 "	136				
					79				
				16)	215	(13.44, average distance from centre.			

Note.—The great discrepancies in the above table can only be accounted for by the great inaccuracy of the cast-iron gun.

* Not having the use of the eprouvette until after the experiments were nearly completed, by eprouvette, and found to vary from 20 to 30 yards in the same barrel. This was caused,

A.

557 yards from the guns.—(See plate 1, fig. 3.)

WROUGHT-IRON GUN.

Charge of powder.		Elevation.	Distance at which shot first struck target, &c.	Shot passed from vertical line on target.		From tangent to point struck first.	General velocity.	Time of flight.	Radius of circular arc described.
Lbs.	*Yards. proof.**	*Deg. min.*	*Yards.*	*Right.*	*Left.*	*Feet.*	*Feet per second.*	*Seconds.*	*Feet.*
14	–	2 7½	557	–	7 ft.	68	811	2.06	20.531
14	–	2 7½	680	Over	middle	86	876	2.32	24.200
14	–	2 7½	500	–	3 ft.	65	746	2.01	17.315
14	–	2 10	535	3 ft.	–	71	758	2.11	18.141
14	–	2 10	557	–	1 "	64	835	2.00	21.815
14	–	2 10	545	1 "	–	71	775	2.11	18.825
14	–	2 10	557	2 "	–	72	788	2.12	19.390
14	–	2 10	557	1 "	–	70	800	2.09	19.944
14	–	2 10	557	–	7 "	72	788	2.12	19.390
14	–	2 12	557	–	1 "	68	811	2.06	20.531
14	–	2 15	557	0 "	0 "	64	835	2.00	21.815
14	–	2 15	557	2 "	–	75	760	2.20	18.615
14	–	2 15	557	0 "	0 "	66	823	2.03	21.120
14	–	2 20	557	3 "	–	68	811	2.06	20.531
14	–	0 40	360	0 "	0 "	24	885	1.22	24.300
14	–	0 40	300	6 "	–	20	804	1.12	20.250
14	–	0 40	350	–	2 "	24	861	1.22	22.968
20	–	1 30	557	–	2 "	47	977	1.71	29.705
20	–	1 30	490	–	3 "	47	860	1.71	22.988
20	–	1 30	557	–	2 "	46	983	1.70	30.350
20	–	1 30	557	2 "	–	46	983	1.70	30.350
20	–	1 30	557	–	2 "	46	983	1.70	30.350
				20	30				
				30					
			22)	50	(2.27 av	erage dis	tance from	centre	line.

Note.—The average distance from the centre line would have been less, but that several shot were aimed at points distant from the centre line. This, with the variableness in the strength of the powder, will account for the slight discrepancies that may appear in the above table.

we could not ascertain, before using it, the strength of the powder. It was tried afterwards no doubt, by the openness of the house in which it was for some time kept.

B.

Table showing the result of firing with the wrought-iron gun at a target 910 yards from the gun.

The first shot struck an inclined sand-bank in front of the target, and bounded over; the rest struck as shown in plate 1, fig. 4.

Charge of powder.		Elevation.	Distance to point first struck target	Shot struck from centre line at target.		Deflection of ball from target.	General velocity.		Radius of circular arc described.
Pounds.	*Yards proof.**	*Deg. min.*	*Yards.*	*Right.*	*Left.*		*Feet.*	*Seconds.*	
20	–	2 30	840	6 feet	–	119	923	2.75	26.682
20	–	2 40	890	6 "	–	133	927	2.88	26.800
20	–	2 50	910	0 "	0 "	139	925	2.95	26.809
20	–	2 50	860	–	6 feet	136	883	2.92	24.472
20	–	2 50	910	9 "	–	143	913	2.99	26.059
20	–	2 50	910	8 "	–	139	925	2.95	26.809
25	–	2 20	910	3 "	–	114	1019	2.67	32.688
25	–	2 20	910	3½ "	–	114½	1018	2.68	32.404

In calculating the velocities in these tables, gravity is taken at 32.315, and the resistance of the air allowed for.

* See remarks in table A, amply sufficient to account for the only discrepancy in this table.

C.

Table showing the recoil of the wrought-iron gun, with different charges of powder.

Charge of powder.	Recoil.
14 pounds.	28 inches.
20 do.	33 do.
25 do.	36 do.

D.

Table showing the ranges of the 212-pound gun, with 25 pounds of powder, as found by experiment and by calculation, according to the rule found to give the ranges of this gun so far as tried, to wit: that the deflections from the tangent are as the 2.10th power of the range. The ranges in the table are to the plane of the gun, except the shot fired at 34 minutes, which was to the ground.

Elevation.		Range.	Deflections.	
Deg.	*Min.*	*Yards.*	*Yards.*	
0	34	440	8	To the ground, 14 or 15 feet below.
1	0	409	7	To plane of gun.
2	0	767	27	Do.
3	0	1,112	59	Do.
4	0	1,440	100	Do.
5	0	1,763	153	Do.
6	0	2,077	217	Do.
7	0	2,391	291	Do.
8	0	2,697	375	Do.
9	0	2,999	469	Do.
10	0	3,298	572	Do.
11	0	3,593	685	Do.
12	0	3,883	803	Do.
13	0	4,173	939	Do.
14	0	4,458	1,078	Do.
15	0	4,740	1,227	Do.
16	0	5,020	1,383	Do.
17	0	5,263	1,549	Do.

E.

Table showing the absolute resistance, and the comparative effect of the resistance, of the air upon balls of 42 and of 212 lbs. weight at different velocities.

Velocity.	Absolute resistance in pounds.			Comparative resistance in terms of the weight of the ball.	
Feet per sec.	1-lb. ball.	42-lb. ball.	212-lb. ball.	42-lb. ball.	212-lb. ball.
200	0.69	8.15	25.07	0.18	0.11
400	2.81	33.19	102.10	0.79	0.48
600	6.69	79.00	243.07	1.88	1.15
800	12.81	151.29	465.16	3.60	2.19
1000	21.88	258.40	794.97	6.16	3.74
1200	34.13	403.07	1,240.06	9.59	5.85

As a cannon ball would have *in vacuo* a range about eight times as great as its actual range in the air; and as the effect of the air upon the motion of a 212-lb. ball is only about six-tenths as much as upon a 42-lb. ball, (compare the last two columns of the preceding table,) it is easy to be perceived why the latter, with a high initial velocity, should have a much less range than the former, with a moderate initial velocity.

No. 2.

FLUSHING, N. Y., *December* 21, 1842.

SIR: I have the honor to inform you that I have made an examination of the 12-inch wrought-iron gun of Captain Stockton, now at the Phœnix foundry, in New York. On the exterior of the gun, is a crack on the upper part of the band which connects the trunnions to the gun; a crack on the under part of the body of the gun, in the reinforce. One of the bands which have been put on to secure the gun in this part, has been cracked, and is taken off; and both the arms of the breeching-cleat, formed on the screw-nut of the bolt through the breech, are slightly cracked. The band connecting the trunnions was put on the gun when heated, and shrunk on very tight—so much so, as to compress the metal of the gun in this part. The fracture of it, I learn, took place on the first discharge of the gun, in Philadelphia, with a blank cartridge; since which, it has not altered. It does not extend the whole width of the band. Its depth cannot be ascertained. This band was not put on for the purpose of strengthening the gun, but for securing the trunnions, which remain firm. It is about 11 inches in width and $2\frac{1}{2}$ inches in depth or thickness. The band which has been taken off from the reinforce, was one of four which were put on over a rent which appeared, and to strengthen the gun in this part, and are each nearly 9 inches in width and $2\frac{3}{4}$ in depth. These bands were also put on the gun hot, and shrunk on; and it being probably tighter than the others, and owing to the extreme tension of the metal, it broke from the concussion of the gun after a number of discharges—how many, I am not informed. These four bands were placed contiguous to each other, and so neatly finished that their joints could not be distinguished, and in appearance formed one band. The rent in the solid part of the gun is barely perceptible when it is uncovered by the displacement of the band. Its extent I cannot tell; but I should judge that no alteration had taken place since the band was put on, and that the band was broken by the concussion, rather than by any opening or enlargement of the gun itself.

The fracture of the arms of the breeching-cleat was caused, I understand, by the unskillful use of a lever in handling and moving the gun. I consider them sufficiently strong for present use, as they are only useful in keeping the breeching in place, if one should be used, and no great strain is brought on them by it. Indeed, I do not know that a breeching has been used in any of the trials made.

The bore of the gun does not appear to have been at all affected by the firing, as I supposed it would have been. I learn that it has been fired about fifty times, with charges of 14 and 20 lbs. powder; once with 35 lbs. I can perceive no action of the shot on any part of it, nor any

change of shape produced by firing. It is smaller in the wake of the trunnion-band by about $\frac{3}{100}$ of an inch, than it is either at the muzzle or at the bottom of the bore. This, I think, was caused by the compression of the metal (however singular it may appear) at the time of putting on the band. No cutter would have left such a shape in boring, and the bore appears regular and true in every other respect.

Part of the shot used in firing were covered with felt, and part of them without cover. There are three or four slight blemishes in the bore, but I do not consider them of any consequence. They appear to have been in the gun when first bored.

As Captain Stockton was unable to be present at the time of inspection, a copy of this report will be sent to him.

I have the honor to be your obedient servant,

ALEX. S. WADSWORTH.

Com. WILLIAM M. CRANE,
Chief of the Bureau of Ordnance, &c.

No. 3.

UNITED STATES SHIP PRINCETON,
New York, January 16, 1844.

SIR: I have the honor to inform you that I yesterday *proved* the big gun with the following charges:

1st charge 14 pounds powder.
2d " 14 " "
3d " 20 " "
4th " 25 " "
5th " 45 pounds powder, and 212½ lb. shot.

The powder used was 276 yards proof, which makes the *true proof* applied to the gun $49\frac{6}{100}$ pounds.

As a gun, it is quite perfect, and I do not think that *any* charge of powder can injure it; and as a piece of forged work, it is certainly the greatest achievement up to this time. It is safe in its carriage on board of the ship, and I hope within ten days to be with the ship at Washington.

Most respectfully, your obedient servant,

R. F. STOCKTON.

P. S.—The men who made it deserve their money. It is worth all the guns on board of any frigate.

NOTE.—The large gun weighed 27,334 pounds.

No. 4.

Statement of cost (as paid by the Bureau of Ordnance and Hydrography) of the first wrought-iron cannon made under the directions of Captain R. F. Stockton, United States navy.

Paid requisition of Thomas Hayes, navy agent at Philadelphia, dated 10th August, 1842	$3,600 00
Paid amount of Hogg and Delamater's bill, approved by Captain R. F. Stockton, for work done on wrought-iron cannon	1,600 36
	$5,200 36

BUREAU OF ORDNANCE AND HYDROGRAPHY, *April* 1, 1844.

W. M. CRANE.

Statement of cost (as paid by the Bureau of Ordnance and Hydrography) of the second wrought-iron cannon made under the directions of Captain R. F. Stockton, United States navy.

January 20th, 1844.—Paid requisition of Thomas Hayes to pay bill of Hogg and Delamater, approved by Captain R. F. Stockton, for wrought-iron cannon	$9,914 95
March 18, 1844.—Paid bill of Hogg and Delamater, approved by Captain R. F. Stockton, for labor, &c., on wrought-iron cannon	1,573 27
	$11,488 22

BUREAU OF ORDNANCE AND HYDROGRAPHY, *April* 1, 1844.

W. M. CRANE.

NAVY DEPARTMENT, *May* 8, 1844.

SIR: Agreeably to your verbal request, I have the honor to transmit, herewith, the following papers, marked A, B, and C, viz:

A.—Copy of authority from the President of the United States to the Secretary of the Navy, dated March 14, 1844, to construct another wrought-iron gun.

B.—Copy of a letter, dated March 15, 1844, from the Secretary of the Navy *ad interim* to the Chief of the Bureau of Ordnance and Hydrography.

C.—Copy of a letter from the chief of the said bureau to Captain R. F. Stockton, dated March 16, communicating the authority of the President.

I am, very respectfully, your obedient servant,

J. Y. MASON.

Hon. WM. PARMENTER,
Chairman Naval Committee, Ho. Reps.

A

WASHINGTON, *March* 14, 1844.

Being entirely satisfied, from the report of the late court of inquiry, that no vestige of pretence remains to visit the slightest censure on the officers and crew of the Princeton, either collectively or individually, for the sad and melancholy accident which has occurred on board that ship; and regarding the bursting of the gun as one of those incidents which have often before attended the use of cannon of every size and description; and being firmly impressed with the great importance of the Princeton as a ship of war, it has therefore seemed to me to be altogether proper to direct the construction of another gun of the size and dimensions of that lately destroyed.

I have, therefore, thought proper to order that such a gun be wrought, under the direct supervision of Captain Stockton, as soon as may be; and that the same be paid for out of any unexpended balance remaining of the appropriation for navy ordnance.

JOHN TYLER.

To the SECRETARY OF THE NAVY.

B.

NAVY DEPARTMENT, *March* 15, 1844.

SIR: I transmit herewith a copy of an order from the President of the United States, directing that another wrought-iron gun be made, under the immediate supervision of Captain Stockton, and request you will take measures for carrying the order into effect.

I am, very respectfully, yours,

L. WARRINGTON,
Secretary of the Navy ad interim.

Commodore WM. M. CRANE,
Chief of the Bureau of Ordnance and Hydrography.

C.

BUREAU OF ORDNANCE AND HYDROGRAPHY,
March 16, 1844.

SIR: You have herewith, enclosed, copies of letters from the President of the United States and from the Secretary of the Navy, ordering to be constructed, under your immediate supervision, as soon as may be, another wrought-iron gun of the size and dimensions of that lately destroyed on board the "Princeton." You will be pleased to carry into effect this order, reporting to this bureau, from time to time, your progress.

Very respectfully, your obedient servant,

W. M. CRANE.

Captain R. F. STOCKTON,
U. S. Navy, Philadelphia.

Fold out

Fold
out